Pacific Commercial Fishery Updates For Invertebrate Resources (1997)

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PACIFIC COMMERCIAL FISHERY UPDATES FOR INVERTEBRATE RESOURCES (1997)

by

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ABSTRACT

Harbo, R.M. and E.S. Wylie [editors] 2002. Pacific commercial fishery updates for invertebrate resources (1997). Can. Manuscr. Rep. Fish. Aquat. Sci. 2586: v + 209 p.

Fishery updates present catch and effort data and identifies fisheries management and stock assessment issues in the many invertebrate fisheries on the Pacific coast of Canada. These papers often form the basis for requests for stock assessment advice.

There are more than 25 species of invertebrates exploited commercially and in 1997 the reported landings were 24,759 tonnes, a reduction from 1996 primarily due to development of Shrimp Management Areas (SMA's) quotas within the shrimp trawl fishery and quota reductions in the red sea urchin fishery. The landed value of invertebrates slightly decreased to approximately $121 million.

The report has been organised by sections on molluscs, echinoderms and crustaceans. Specific gear types are identified in each section.

RÉSUMÉ

Harbo, R.M. and E.S. Wylie [editors] 2002. Pacific commercial fishery updates for invertebrate resources (1997). Can. Manuscr. Rep. Fish. Aquat. Sci. 2586: v + 209 p.

Les bilans des pêches des invertébrés donnent des données sur les prises et l'effort et identifient les problèmes de gestion des nombreuses espèces pêchées sur la côte canadienne du Pacifique, ainsi que les problèmes d'évaluation des stocks. Ces documents sont souvent utilisés dans la formulation de conseils pour l'évaluation des stocks.

Plus de 25 espèces d'invertébrés sont l'objet d'une pêche commerciale. Les débarquements déclarés en 1997, qui se chiffraient à 24 759 tonnes, étaient inférieurs à ceux de 1996; cette baisse est en grande partie imputable à l'établissement de quotas par zone de gestion de la crevette s'appliquant à la pêche de la crevette au chalut et à des réductions des quotas d'oursin rouge. La valeur des invertébrés au débarquement a légèrement diminué, pour atteindre environ 121 millions de dollars.

Le présent rapport est divisé en trois sections, comme suit : les mollusques, les échinodermes et les crustacés. Les engins utilisés pour pêcher chaque groupe sont identifiés dans la section pertinente.

102-03721/

1.0 INTRODUCTION

This is one of a series of documents reporting on the fisheries and stock status of invertebrate resources on the Pacific coast of Canada. Earlier reports include Bernard (1982), Jamieson (1985), Jamieson and Francis (1986), Harbo and Jamieson (1987), Thomas (1990, 1992) and Harbo and Hobbs (1997).

Since 1986 there have been annual summaries of invertebrate fisheries published in the annual reports of the Pacific Stock Assessment Review Committee (PSARC): Stocker, et al, 1987; Stocker, et al, 1988; Farlinger, et al, 1989; Farlinger, et al, 1990; Farlinger, et al, 1991; Irvine, et al, 1992; Irvine, et al, 1993; Humphreys, et al, 1994; and Rice, et al, 1995.

This manuscript presents fishery data summaries and preliminary analyses of catch and effort data from fish slips and harvest logs.

Fishery updates are presented to the invertebrate PSARC subcommittee annually in the fall. Scientific advice is developed through PSARC and meetings of the regional DFO shellfish working group and regional advisory committees with client representatives.

The fishery updates in this document are organised by species groups rather than fishery gear types.

1.1. Invertebrate Species Exploited (1997)

There are three major groups of invertebrates harvested; molluscs, crustaceans and echinoderms. A list of common names and scientific names are presented in Table 1.1, as well as licence categories, gear types and numbers of licences issued in 1997.

All fisheries for northern abalone (Haliotis kamtschatkana), were closed in December 1990, pending further stock assessments and signs of recovering and rebuilding stocks.

1.2. Landings and Landed Values (1997)

The landings and landed values of invertebrate fisheries resources are in Tables 1.2 and 1.3.

1.3. Pacific Fishery Management Areas

The Pacific Fishery Management Areas are shown for the South Coast (Fig. 1.1) and the North Coast (Fig. 1.2). The Fisheries Management Sector is divided into three divisions for marine fisheries: the North Coast Division (Areas 1 to 10), South Coast Division (Areas 11 to 27), and the Fraser River Division (Areas 28 and 29). Invertebrate resources in offshore areas are managed by the adjoining inshore divisions.

1.4. Management Framework for Invertebrate Fisheries

A brief description of fishery management framework by species for 1997 is shown in Table 1.4.

1.5. Common Biological Objectives

There are objectives by all others fisheries. These objectives are to understand oceans and aquatic resources, to manage and protect the fisheries resource, to maintain and protect the marine and freshwater environment, to maintain maritime safety, and to facilitate maritime trade, commerce and ocean development.

The Biological Objective Working Group of the Pacific Stock Assessment Review Committee identified three biological objectives for management of Pacific Region fish and invertebrate stocks (Rice *et al.* 1995). They are:

1. Ensure that subpopulations over as broad a geographical and ecological range as possible do not become biologically threatened (in the COSEWIC sense of "threatened").

2. Operationally, Objective 1 requires at least that management allow enough spawners to survive, after accounting for all sources of mortality (including all fisheries and natural mortality), to ensure production of enough progeny that they will be able to replace themselves when mature.

3. Fisheries may have collateral effects on other species, mediated by the ecological relationships of the target species. Fisheries should be managed in ways that do not violate the above objectives for ecologically related species, as well as target species.

1.6. Fishery Management Objectives

General management goals and objectives are common to all shellfish fisheries described in the annual management plans produced by the Department. The objectives are:

- To ensure conservation and protection of invertebrate stocks and their habitat through the application of scientific management principles applied in a risk averse and precautionary manner based on the best scientific advice available.
- To meet the federal Crown's obligations regarding Aboriginal fisheries for food, social and ceremonial purposes.
- To develop sustainable fisheries through partnership and co-management arrangements with client groups and stakeholders to share in decision making, responsibilities, costs and benefits.
- To develop fishing plans and co-operative research programs which will contribute to improving the knowledge base and understanding of the resource.
- To consider the goals of stakeholders with respect to social, cultural and economic value of the fishery.
- To consider health and safety in the development and implementation of management plans, fishery openings and closures.
- To consider opportunity for the development of the aquaculture industry.
- To provide opportunities for recreational fisheries.

Table 1.1. List of common and scientific names of commercially exploited species of invertebrates in British Columbia in 1997.

Phylum - Class common name	Scientific name	Gear Type	Licence Category	# of eligible Licences[1]	Comments
PHYLUM MOLLUSCA					
CLASS BIVALVIA					
geoduck (king clam)	Panopea abrupta	dive	G	55	
horse clam (gaper clam)	Tresus capax, Tresus nutallii	dive / intertidal	G	55	
manila clam	Tapes philippinarum	intertidal	Z2	1601	Not limited entry
littleneck (native) clam	Protothaca staminea	intertidal	Z2	1601	Not limited entry
butter clam	Saxidomus gigantea	intertidal	Z2	1601	Not limited entry
razor clam	Siliqua patula	intertidal		0 [2]	[2] See footnote
pink (smooth, swimming)	Chlamys rubida	dive / net	ZI,ZR	ZI-41,ZR-38	Not limited entry
spiny (pink, swimming)	Chlamys hastata	dive / net	ZI,ZR	ZI-41,ZR-38	Not limited entry
CLASS CEPHALOPODA					
Pacific octopus	Octopus dofleini	dive / trap	ZG,ZP	ZG-77,ZP-235	Not limited entry
opal squid	Loligo opalescens	net	ZE	55	Not limited entry
PHYLUM ARTHROPODA					
CLASS CRUSTACEA					
SUBCLASS MALACOSTRACA					
euphausiids (krill)	Euphausia pacifica	net	ZF	18	
prawn (spot shrimp)	Pandalus platyceros	trap	W	253	
smooth pink shrimp	Pandalus jordani	trap / net	W,S	W-253, S-246	
northern (spiny) pink shrimp	Pandalus borealis	trap / net	W,S	W-253, S-246	
flexed pink shrimp	Pandalus goniurus	trap / net	W,S	W-253, S-247	
sidestripe shrimp	Pandalopsis dispar	trap / net	W,S	W-253, S-246	
coonstripe shrimp	Pandalus danae	trap / net	W,S	W-253, S-246	
humpback shrimp	Pandalus hypsinotus	trap / net	W,S	W-253, S-246	
Dungeness crab	Cancer magister	trap	R	221	
red rock crab	Cancer productus	trap	R	221	
red (Alaska) king crab	Paralithodes camtschatica	trap	R	221	
golden (brown) king crab	Lithodes aequispina	trap	R	221	

Table 1.1. List of common and scientific names of commercially exploited species of invertebrates in British Columbia in 1997 (con't).

Phylum - Class common name	Scientific name	Gear Type	Licence Category	# of eligible Licences[1]	Comments
SUBCLASS CIRRIPEDIA					
gooseneck barnacles	Pollicipes polymerus	intertidal	Z6	49	Not limited entry
PHYLUM ECHINODERMATA					
CLASS ECHINOIDEA					
red sea urchin	Strongylocentrotus franciscanus	dive	ZC	110	
green sea urchin	Strongylocentrotus droebachiensis	dive	ZA	49	
CLASS HOLOTHURIODEA					
California sea cucumber	Parastichopus californicus	dive	ZD	85	

[1] - number of eligible commercial fishing licences in 1997

[2] - 6 non-native fishermen were eligible for licences, the other fishermen were designated from a communal commercial licence held by the Council of the Haida Nation (CHN).

Table1.2. Landings of invertebrates in tonnes in British Columbia, 1984-1997

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996*	1997*
INTERTIDAL CLAMS - Commercial Fishery:														
Razor	100	90	142	142	155	117	114	117	55	44	105	140	76	101
Butter	130	251	158	68	134	92	109	42	132	102	174	101	100	145
Manila[1]	1677	1913	1893	3607	3909	2764	1456	982	914	1059	1376	1292	1161	875
Nat. Ln.	294	191	284	373	290	433	465	201	116	131	94	140	56	60
Mixed	410	477	371	87	27	159	339	137	124	133	87	3	112	112
SubTotal: Commercial Fishery	2611	2922	2848	4277	4515	3565	2483	1479	1341	1469	1836	1676	1505	1293
FARMED CLAMS		4	7	25	30	31	39	169	300	300	500	885	1000	1000
TOTAL INTERTIDAL CLAMS	**2611**	**2926**	**2855**	**4302**	**4545**	**3596**	**2522**	**1648**	**1641**	**1769**	**2336**	**2561**	**2505**	**2293**
GEODUCK	3483	5370	5006	5734	4567	3985	3956	3333	2864	2455	2235	2098	1842	1796
HORSE CLAM	7	6	96	355	325	115	124	110	2	23	62	1	-	4
SHRIMP	408	678	768	2644	2561	2299	1940	3265	2683	3283	3192	7257	7464	3038
PRAWN	505	514	550	620	720	620	761	961	1168	1215	1309	1300	1723	1800
CRAB[3]	1155	1165	1321	1631	1508	1522	2168	1887	3355	6306	6002	4747	4947	3943
ABALONE	58	42	52	49	49	49	50	N/A	N/A	N/A	N/A	N/A		
OCTOPUS	25	32	53	129	209	217	198	131	117	145	72	95	139	207
SEA URCHIN	1764	1815	2067	2223										
RED					2116	2658	3158	6945	12018	6388	5829	6590	6272	4653
GREEN[4]					444	609	475	607	1042	714	332	157	150	160
SEA CUCUMBER[2]	113	346	786	1722	1922	1144	870	1340	1242	812	556	588	636	631
SCALLOP	18	53	68	66	67	75	69	82	91	90	104	96	102	73
PLANKTON	103	131	166	130	247	360	530	450	380	53	333	562	507	382
SQUID	69	111	79	86	88	70	72	116	93	13	175	76	78	6
MUSSELS	1	tr	2	2	3	4	1	tr	0	0	0	0	0	0
GOOSENECK BARNACLES		tr	2	32	49	30	37	40	38	30	19	8	12	10
OYSTERS - Farmed	2897	3420	2864	3482	3702	3721	4547	4482	4500	4000	4900	5300	5700	5900
TOTAL TONNES	**13217**	**16609**	**16735**	**23207**	**23122**	**21274**	**21478**	**25397**	**31234**	**27296**	**27456**	**31436**	**32077**	**24696**

*preliminary landings for non-validated fisheries for 1996 and 1997.

[1] the sum of commercial fishery landings, depurated and Aboriginal licenced harvest, and not including production from clam tenures

[2] landings are round weight

[3] crab landings include tanner, king, other and dungeness crabs (1989 to 1997)

[4] red and green sea urchin landings form 1995 to 1997 taken from validation logs

Table 1.3. Landed value of invertebrates in thousands of Canadian dollars in British Columbia, 1984-1997

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996*	1997*
INTERTIDAL CLAMS - Commercial Fishery:														
Razor	123	95	127	126	137	124	130	129	82	67	186	247	135	174
Butter	55	138	75	40	63	44	53	34	81	60	103	71	70	103
Manila	1813	2278	2762	6003	7175	6003	3761	2574	2253	2761	3776	4158	3349	3321
Nat. Ln.	311	202	327	474	359	588	710	327	193	212	147	241	100	117
Mixed	455	575	510	132	36	196	625	238	252	271	198	7	193	192
SubTotal: Commercial Fishery:	2757	3288	3801	6775	7770	6955	5279	3302	2861	3371	4410	4724	3846	3907
Farmed Clams:		4	14	43	59	96	140	556	1000	1200	1900	3885	4750	4900
TOTAL INTERTIDAL CLAMS	**2757**	**3292**	**3815**	**59**	**7829**	**7051**	**5419**	**3858**	**3861**	**4571**	**6310**	**8609**	**8596**	**8807**
GEODUCK	2937	4605	4294	6184	9762	12967	10582	9659	16237	26994	33426	43284	36255	33700
HORSE CLAM	5	6	63	309	300	144	274	119	2	46	111	3	0	7
SHRIMP	1022	1180	1240	4609	2802	2985	2637	4430	2831	3494	4772	14123	11725	5423
PRAWN	3262	3379	3734	4326	5724	7083	7006	7728	8380	10121	12133	17722	26099	26013
CRAB	4558	4719	5661	6452	5945	6088	9311	8688	11203	18761	25686	24058	23418	28697
ABALONE	530	442	734	973	1076	1170	1347	N/A	N/A	N/A	N/A	N/A	N/A	N/A
OCTOPUS	56	82	136	381	651	707	657	415	350	447	231	317	500	729
SEA URCHIN	712	763	1011	1276										
RED					1241	1631	1953	4187	8660	5271	8038	11269	12199	8506
GREEN					584	1020	948	1795	4424	3777	2122	648	921	863
SEA CUCUMBER	22	94	236	768	961	998	1168	1029	1363	982	1035	947	925	1019
SCALLOP	56	95	212	244	285	316	317	387	420	423	490	476	503	743
PLANKTON	42	89	113	102	192	223	415	390	318	41	259	357	472	335
SQUID	84	184	127	132	113	94	81	148	135	17	199	95	97	9
MUSSELS	tr	0	tr	tr	tr	tr	1	tr	0	0	0	0	0	
GOOSENECK BARNACLES		1	4	211	479	343	413	418	448	320	181	80	112	95
OYSTERS - Farmed	2109	2613	2515	2548	2725	2938	3613	3465	3600	4700	4500	5500	6000	6300
TOTAL VALUE ($000)	**18152**	**21544**	**23895**	**28574**	**40669**	**45758**	**46142**	**46716**	**62232**	**79965**	**99493**	**127488**	**127822**	**121246**

*preliminary values for 1996 and 1997.

[1] the sum of commercial fishery values, estimated depurated and Aboriginal licenced harvest value, and not including production from clam tenures

[2] values include tanner, king, other and dungeness crabs (1989 to 1997)

[3] value estimated from sales slips for 1995/96/97

Table 1.4. Management framework for invertebrate fisheries, 1997.

SPECIES	LICENCES	QUOTA	SEASONS	COMMENTS
Geoduck	Limited entry (G tab). 55 licenses. Vessels may have no more than 3 licences (stacked licences) Licence conditions include notification, validation and catch reporting requirements Validation costs funded by licence holders.	1997 quota is 1796.26 t for I.V.Q.'s of 32.66 t (72,000 lb) Quota cannot be carried over to the following year	Varies by area	Fishery areas are in a three year rotation. Quotas based on an annual yield of 1% of the virgin biomass.
Horse Clam	Limited to the 55 geoduck licences.	No directed fishery. Caught incidentaly Catch Ceilings: West: 7 t Inside: 13 t	Varies by area and only in areas open to geoduck harvesting.	No harvest in eelgrass beds. West=portions of 24 & 25 Inside=portions of 13,15, 18 & 19
Green Sea Urchin	Limited entry. 49 licences Notification required prior to commencement and termination of fishing in an area. (ZA tab)	I.Q.'s 3.39t (7,471 lb) in South. North: Closed, may be fished under exploratory protocol.	Nov. 12/96 to Jan 31/97 Area Quotas.	Handpicking by divers only. Permanent closures in marine protected areas. Minimum size limit in effect.
Red Sea Urchin	Limited entry. 110 licences ZC tab with area selection. Notification required prior to commencement of fishing. Weekly catch hails required on the south coast	I.Q.89.6t (197,439 lb) 19 Quota's South 91 Quota's North North Catch Ceiling 8,150 t.	Area Quotas and time closure for market demands.	ECVI: Max 149,421 WCVI: Max 48,018 Combined S. Coast quota Minimum size limit in effect.
Gooseneck Barnacle	Not limited entry (Z6 tab) 49 licences issued in 1997.	None.	All year.	Less than 10% of the stock is available for harvest due to harvest conditions or unsuitable size and quality for the available markets.
Pink and Spiny Scallop (Net Gear)	Not limited entry. ZR - 38 licences issued in 1997 for trawl or drag.	None. Managed by size limit.	Some permanent area closues	
Pink and Spiny Scallop (Dive Gear)	Not limited entry. ZI - 41 licences issued in 1997 for diving.	None. Managed by size limit.	Some permanent area closues	
Plankton - Euphausiids	Limited entry. 18 ZF licences	Mainland inlets: 275 t. Strait of Georgia: 225 t.	Nov. - Dec. Opened Aug. - Oct. 31 on request.	

Table 1.4. (continued)

SPECIES	LICENCES	QUOTA	SEASONS	COMMENTS
Octopus (by Trap)	Not limited entry. ZP tab. 235 licences issued in 1997.	None.	Limited to the prawn fishing season.	
Octopus (by Dive)	Not limited entry. ZG tab. 77 licences issued in 1997.	None.	All year with seasonal closures for spawning	Harvest from shore without a vessel is not permitted.
Prawn/Shrimp by Trap	Limited entry. W tab. 253 licences eligible 1997	Managed by time and area closures based on a minimum escapement of the spawner cohort. Minimum size limit and gear escapement regulations.	Apr 23 - July	
Shrimp Trawl	Limited entry. 248 S tab licences.	Catch ceilings by Shrimp Management Area (SMA)	All year, with in-season monitoring of shrimp counts. Area closures. No prawn retention in areas closed to prawn trap fishing	New licence year Apr 16/97 - Apr 15/98
Squid	Not limited entry. ZE tab. 55 licences issued in 1997.	None.	Permanent area closures.	
Crab	Limited entry. R tab. 221 licences were eligible in 1997.	Managed by size limit. No quota. Area-specific trap limits. Trap escapment regulations.	Area licencing, area closures due to softshell or allocation to aboriginal or sport fisheries.	Non-retention of females. Rot panel size set for traps without hinged lids from 20 to 11 cm Crab traps to be fitted with one escape hole at least 110 mm diameter
Intertidal Clam	Not limited entry. Z2 tab. 1601 licences issued in 1997.	Managed by min. size limit. No Quotas.	Seasonal openings and closures, staggered openings to maintain market supply. Closures for allocation to aboriginal and sport fisheries.	Area-specific licences, licence holders choose 1 of 7 areas. 5 companies currently harvesting clams under a depuration licence.
Sea Cucumber	Limited entry. ZD tab. 85 eligible licences.	1997 Quotas: WCVI: 16.46 t ECVI: 41.14 t CC : 87.8 t PR : 87.8 t I.Q.'s = 2.74 t	Open Sept. 22 to Oct. 12 Landings monitored by port validators. Area rotation in the south.	I.Q.'s may be stacked.

Figure 1.1. Pacific Fishery Management Areas (PFMA).

2.0 MOLLUSCS

2.1. Geoduck Clam Fishery - S. Heizer and E. Rome

2.1.1 Introduction

The geoduck (Panopea abrupta) has been fished commercially by divers in British Columbia since 1976. Annual landings peaked at 12.6 million lb. (5735 t) in 1987, and the commercial fishery has landed more than 140.5 million lb. (63,743 t) over the period 1976 to 1997 (Table 2.1.1).

The price paid to fishermen for geoduck has increased significantly since 1987. These increases have occurred primarily because of premium prices paid for live clams in Hong Kong and the Peoples Republic of China. In 1997, prices varied between $2.50 and $11.00 per pound ($5.51 - $24.25 per kg) with an average of $8.51 per pound ($18.76 per kg). The total annual value of the fishery decreased from a record high of $43.3 million in 1995 to $33.7 million in 1997, and is the highest in value among shellfish species (Table 2.1.1). This drop in value has been attributed to the continuing presence, in international markets, of large quantities of cheaper product from Washington State.

Geoducks are currently marketed live, whenever possible, due to high prices paid for live product by the East Asian markets. Few are processed into neck and body meat. P-licences for processing at sea have been issued for the north coast and the option has been available for the West Coast of Vancouver Island (WCVI) since 1992. There has been no processing at sea in the south due to higher prices for live geoducks.

2.1.2 Biological and Fishery Management Objectives

The biological objective of this fishery is to harvest the available biomass on a sustainable basis, and to manage this, where possible, on a bed quota basis. To accomplish this, the management objectives are to harvest 1% of the estimated virgin biomass annually by setting individual vessel quotas, validate landings and employ rotational fisheries.

Other objectives are to: maintain an orderly supply of product to the market, establish and monitor conditions of harvest, develop knowledge of the stock, allow for other production such as enhancement, aquaculture and depuration fisheries, encourage exploration in unexploited areas, provide for marine protected areas, marine parks and ecological reserves, and provide for Aboriginal food, social and ceremonial needs.

2.1.3 Fishery Management Actions

Quotas limit landings. A range of quota options ise determined by estimating biomass based on estimates of density, bed area and mean weights, and applying an annual harvest rate which yields a harvest equal to 1% of the original unharvested biomass. The bed area and catch information are retrieved from logbooks, charts and catch statistics These are reviewed annually with fishermen. The coastwide quota is divided into 55 equal quotas, one for each licence. An independent validation company monitors catches.

In the years between 1979 (when area quotas were implemented) and 1989 (when individual vessel quotas were implemented), quotas varied considerably, from a low of 6.2 million lb. (2801 t) in 1981 to a high of 9.3 million lb. (4238 t) in 1987. In 1982, and the years from 1984 through 1988, total allowable catch (TAC) was exceeded each successive year (Table 2.1.2). Since 1990,

the second year of vessel quotas, the TAC and vessel quotas have fallen 7-16% per year (Table 2.1.2) due, in large part, to revised estimates of bed size and densities used in quota calculations.

The coast is divided into 3 license areas, the north coast, the west coast of Vancouver Island (WCVI), and the waters inside Vancouver Island. The number of licences fishing each area changes annually according to the proportion of the total quota assigned to each area (Table 2.1.2). Until 1997, there was a shift in licences to the north coast as new areas were identified there and quotas were reduced in the south to compensate for what appeared to have been overharvesting. In 1997, two licenses from the north coast and 4 licenses from the inside waters moved to WCVI, leaving 29 licences in the north, 9 in southern inside waters and 17 WCVI.

The fishery in the north is organised and scheduled, through on-grounds monitoring, by a charter vessel. This also prevents conflict with the herring and herring spawn fisheries.

Table 2.1.3 shows a historical list of areas and quotas fished from 1989 [the year of implementation of IQs (individual quotas)] through 1997. Table 2.1.4 summarises openings and closures for the 1997 season including reasons for each management action.

2.1.4 Catch and Effort

Tables 2.1.5 and 2.1.6 provide annual catches by Management Area. The 1997 landings by Management Area and month are provided in Tables 2.1.7 and 2.1.8. In 1997 the total validated landings of 3.96 million lb. (1796 t) were slightly greater than the TAC [approx. 0.02% or 83 lb. (37.6 kg)]. A summary of quota overages in 1997 is shown in Table 2.1.9.

It is the current practice of fishers to catch the amount of geoduck, in any fishing day, that is 'ordered' by a buyer. As a consequence, any previous measure of effort (catch per boat day, or diver-day, or hour) has little relationship with those measures from other years, or between boats. For this reason, no attempt has been made here to quantify effort in this fishery.

2.1.4.1 South Coast (WCVI and Waters Inside Vancouver Island)

The 1997 fishery occurred in the third year of a three year rotation (Table 2.1.2). Areas are fished one year in a three year period or rotation, (except Area 24 which is fished annually) There were 26 IQs (47% of the licences) assigned to the south coast in 1997, 9 for inside waters and 17 for the W.C.V.I. Validated landings for 1997 from the south coast (Table 2.1.5) were 1,872,090 lb. (849 t). From inside waters there were 648,049 lb. (294 t) which was 49 lb. (22.2 kg) over quota and from the W.C.V.I. there were 1,224,041 lb. (555 t) which was 41 lb. (18.6 kg) over quota. Fishing took place all year for live markets.

The south coast inside/mainland waters have very large beds, which have been delineated and measured. From 1989 to 1993 these beds have maintained an allocation in the south of 12 licences, in spite of decreases in the quota and IQs. In 1994, the number of inside licences dropped to 10 and, in 1995, rose to 11. In 1996, the number rose to 13, then dropped, in 1997, to 9. The 9 inside licenses for 1997 were not consolidated; they were fished on 9 separate vessels (Table 2.1.10).

The bed areas have been modified based on advice from fishers and interpretations of landing data. Several bed closures were initiated between 1992 to 1997 (Table 2.1.11). The effect of these closures has not been evaluated.

From 1989 to 1996, the number of licences for WCVI has been reduced each year, due to closures of heavily harvested areas and proportionally greater northern quotas. Initial evaluation of these actions include: exploratory fisheries in the south coast (Table 2.1.12), surveys in the north and south coasts (Table 2.1.13) and long term studies in the south

coast (Table 2.1.14), in 1996. In 1997, there were 17 licences for WCVI, an increase of 6 from the previous year (Table 2.1.3). There was no stacking of licences on the West Coast; each licence was fished on a separate vessel (Table 2.1.10). Landings for 1997 are presented in Table 2.1.5.

The south coast areas have more bed area identified and a greater estimated original biomass than the north coast. This has resulted in maintaining quotas in the south in spite of the long history of fishing. Some of the bed areas have been assessed and reduced and some beds have been closed due to concerns about overharvesting. Table 2.1.2 lists management actions and Table 2.1.3 lists the areas fished in the three-year rotations.

2.1.4.2 North Coast

The 1997 north coast quota was 2,088,000 lb. (946.9 t) which supported 29 licences with an I.Q of 72,000 lb. or 32.6 t per vessel (Table 2.1.3).

Validated landings in 1997 from the north coast were 2,087,993 lb. (947 t), slightly under the quota by 7 lb. (3.2 kg) (Table 2.1.6). Prior to 1992, all product harvested from the north coast had to be processed due to Paralytic Shellfish Poison (PSP) risk.

The 29 licences selected for the north coast were consolidated on 21 vessels (Table 2.1.10), with as many as 3 licences fished on one vessel. No P licences for processing on-board the vessel were active in 1997; this compares to as much as 40% of the catch processed by P-Licence vessels in 1991.

2.1.5 Stock Assessment Activities

DFO and commercial geoduck divers have carried out a number of density surveys and research studies since 1990, initially at Gabriola Island and Ritchie Bay and more recently, since 1993, in co-operation with First Nations in the north and south coast. Tables 2.1.13 and 2.1.14 summarize survey and research activities in 1997.

2.1.6 Stakeholder Participation

The Underwater Harvesters Association (UHA) contributes to a water quality and shoreline assessment program carried out by Department Of Environment Canada (DOE) and to a coastwide PSP sampling program. They also offset the salary of one full-time management biologist for DFO. Other projects funded include several surveys for stock assessment purposes, enhancement activities (seeding juvenile geoducks), a market sampling program and a validation program, the latter being essential for the proper functioning of the Individual Transferable Quota (ITQ) system. The UHA has also funded several *ad hoc* projects such as an unanticipated shell ageing project.

2.1.7 Enforcement Concerns

The validation company reports few incidents requiring reports to DFO (Table 2.1.15). Harvesting of geoducks by unlicenced operators (poaching) and high-grading (sorting and retaining only high quality product) are the main concerns for enforcement personnel.

2.1.8 Priority Issues

2.1.8.1 Annual assessments and reductions in quotas

From 1991 until 1997, the fishery faced a reduction in quotas annually. A two-year plan was set for 1992/1993, to give some stability to the fishery while an assessment was carried out. Annual assessments and reductions have occurred through 1996. In 1997, a two-year assessment covering 1997 and 1998 was conducted. Uncertainties remain about average densities, the size of geoduck beds and recruitment and mortality rates.

Although the declines in quota have been compensated for by dramatic increases in the prices paid for geoducks sent to live markets, fishers feel that these declines send a signal to the market that the industry lacks stability. Fishers requested assessments yielding unchanging quotas over several years. Equal sized quotas of 72,000 lb. (32.6 t) were set for the 1997 and 1998 fishing years.

2.1.8.2 High-grading

There were continued reports of dumping of low quality geoducks, or "high-grading". Competition with quantities of geoducks from Puget Sound (some alleged to have been high-graded) may be an incentive for high-grading in Canada. There was, however, pressure from within industry to land and sell all geoducks regardless of their size and quality.

2.1.8.3 Poaching

Anecdotal information indicates that, as a consequence of the current high prices paid for geoducks, poaching has increased and may be a significant problem. It is reported that much of the product taken illegally is sold domestically and is not showing up in foreign markets. The U.H.A. has directed some effort towards following up on some reported incidents.

2.1.8.4 Aquaculture and Enhancement

Brood stock from Marina Island was first collected in 1993 and juvenile seed geoducks have been produced at a hatchery in Qualicum, B.C. The commercial harvesters, the U.H.A. and a private aquaculture company, FAN Seafoods have jointly supported this hatchery program.

Five areas were selected as experimental sites for aquaculture, two at Marina Island, two at Savary Island and one at Texada Island. FAN Seafoods now has 5 year leases on these areas, and is seeding with juvenile geoducks from the hatchery at Qualicum. In year 5, the project will be evaluated jointly by DFO, FAN Seafoods and The B.C. Ministry of Agriculture Fisheries and Food (MAFF).

The U.H.A. is continuing to harvest wild stocks at the Marina Island, Texada Island and Savary Island sites, in order to remove wild geoducks prior to seeding. These landings have been applied against IQs and area quotas. When wild stock is removed and the sites are seeded, the areas will be removed from the wild fishery. FAN Seafoods has agreed that residual wild geoducks remaining on the sites, when harvested, should be applied against a G licence and the area quota. A non-destructive method for discriminating between wild and cultured geoducks has yet to be developed. Table 2.1.16 summarises 1997 harvest activities and landings. Monitoring of harvest activities at aquaculture sites is required.

The U.H.A. has embarked on an 'enhancement' program that involves seeding several sites in the Strait of Georgia and one site at Ritchie Bay in Clayoquot Sound. The U.H.A. has not developed a seeding plan or study design. The enhancement activities of the U.H.A. differ from the aquaculture activities of FAN Seafoods in that their enhancement activities carry no

claim of ownership of the animals seeded. U.H.A. enhancement activities differ somewhat from those of FAN Seafoods because, although the UHA has some inexplicit expectation of future benefit from UHA-seeded areas, they carry no claim of ownership of the seeded animals. Consequently, the impact of enhancement activities on the wild fishery or its assessment and management cannot be evaluated.

The UHA is currently experimenting with a seed-planting device for juvenile geoducks. No evaluation of enhancement success has yet been made.

2.1.8.5 Licence offsets.

DFO is no longer allowing offsets (reduction of licence fees) for money voluntarily spent by the U.H.A. on stock assessment or management activities. The U.H.A. may withdraw that financial support from co-management programs. This may affect the execution of several programs done by the U.H.A. and DFO, including surveys, experimental work, market sampling, surveillance, enhancement work and an offset for the salary of a full-time management biologist.

Table 2.1.1. Number of licences issued, number of vessels fished, landings and landed values of geoduck clams in British Columbia, as reported on sales slips (1976 to 1988), and on validation logs (1989 to 1996).

Year	Licences Issued	Vessels with Landings	Coastwide Quota (lb)	Coastwide Quota (t)	Total Landings (lb)	Total Landings (t)	Total Value[1] $10^{-3}	Mean Price[2] ($-lb)	Mean Price[2] ($-kg)	Price Range[2] ($-lb)	Price Range[2] ($-kg)
1976	7	5	no quota		97,002	44	N/A	N/A	N/A	N/A	N/A
1977	30	14	no quota		540,898	245	92	0.17	0.37	N/A	N/A
1978	54	27	no quota		2,239,950	1,016	560	0.25	0.55	0.15 - 0.35	0.33 - 0.77
1979	101	72	8,000,000	3,628	5,429,886	2,463	1,683	0.31	0.68	0.13 - 0.40	0.29 - 0.88
1980	95	63	8,000,000	3,628	6,186,067	2,806	2,289	0.37	0.82	0.30 - 0.48	0.66 - 1.06
1981	52	49	6,176,000	2,801	5,961,405	2,704	2,146	0.36	0.79	0.32 - 0.70	0.71 - 1.54
1982	52	53	6,500,000	2,948	6,910,800	3,135	2,764	0.40	0.89	0.22 - 0.46	0.44 - 1.01
1983	54	53	6,500,000	2,948	5,810,913	2,636	1,801	0.31	0.68	0.00 - 0.60	0.00 - 1.32
1984	54	44	6,600,000	2,993	7,678,485	3,483	2,918	0.38	0.84	0.00 - 0.95	0.00 - 2.09
1985	55	52	6,550,000	2,970	11,838,624	5,370	4,735	0.40	0.89	0.00 - 1.00	0.00 - 2.20
1986	55	55	8,775,000	3,980	11,035,396	5,006	4,304	0.39	0.86	0.00 - 0.85	0.00 - 1.87
1987	55	56	9,345,000	4,238	12,643,298	5,735	6,195	0.49	1.08	0.00 - 1.05	0.00 - 2.31
1988	55	56	8,575,000	3,890	10,068,830	4,567	9,767	0.97	2.14	0.03 - 1.88	0.07 - 4.14
1989	55	47	8,800,000	2,992	8,784,247	3,985	12,561	1.43	3.15	0.25 - 1.75	0.55 - 3.85
1990	55	46	8,800,000	2,992	8,722,366	3,956	10,554	1.21	2.67	0.14 - 2.27	0.31 - 5.00
1991	55	47	7,425,000	3,367	7,346,864	3,333	9,477	1.29	2.84	0.58 - 2.55	1.27 - 5.62
1992	55	45	6,311,250	2,863	6,313,748	2,864	16,163	2.56	5.64	1.60 - 5.01	3.53 - 11.04
1993	55	44	5,362,500	2,432	5,365,420	2,434	26,773	4.99	11.00	1.00 - 9.38	2.20 - 20.68
1994	55	45	4,950,000	2,245	4,908,523	2,226	33,722	6.87	15.15	1.20 - 9.00	2.66 - 19.84
1995	55	44	4,621,650	2,097	4,624,330	2,098	43,284	9.36	20.63	3.50 - 15.00	5.86 - 33.07
1996	55	47	4,058,175	1,841	4,059,917	1,842	36,255	8.93	19.68	6.06 - 12.00	13.36 - 26.46
1997[3]	55	42	3,960,000	1,796	3,960,083	1,796	33,700	8.51	18.76	2.50 - 11.00	5.51 - 24.25
Total:					140,527,032	63,743	261,745				

[1] Price paid to commercial fishermen.

[2] Price ranges taken from market reports and sales slips.

[3] Preliminary values.

Table 2.1.2. Summary of quotas, landings and management actions from 1976 to 1996.

Year	Management Units Areas	Quota (tonnes)	Quota (pounds)	Landings[1,2] (tonnes)	Landings[1,2] (pounds)	Management	Eligible Licences	Vessels Fished
1976	South Coast, Strait of Georgia	No quotas		44	97,002	Five operators harvested in designated areas in the Strait of Georgia.	7	5
1977	Coastwide opening	No quotas		245	540,898	All landings from south coast - Strait of Georgia and Tofino region (Area 24).	30	14
1978	Coastwide opening	No quotas		1,016	2,239,950	Licences issued pursuant to Pacific Shellfish Regulations - mechanical harvesting.	54	27
1979	North Coast - 1 management unit	1,587	3,499,449	0	0	Because of increase in effort and landings, licence moratorium and quotas were introduced. South coast Areas 13-19 and 24 were closed Sept. 29, 1979. Other areas in Strait of Georgia and west coast Vancouver Island open to Dec. 31	101	72
	South Coast - 1 management unit	2,041	4,500,551	2,463	5,429,886			
	Totals	3,628	8,000,000	2,463	5,429,886			
1980	North Coast - 4 management units	1,587	3,499,449	68	148,581	Licences limited, South coast areas closed by August 31. First landings from north coast fishery.	95	83
	South Coast - 8 management units	2,041	4,500,551	2,738	6,037,486			
	Inside - 5 units	771	1,700,110	980	2,160,970			
	West Coast - 3 units	1,270	2,800,441	1,758	3,876,516			
	Totals	3,628	8,000,000	2,806	6,186,067			
1981	North Coast - 11 management units	986	2,174,058	509	1,122,173	Licences limited based on previous landing criteria of 13.6 t in 1978 or 1979 for licence eligibility. Closure of areas on west coast of Vancouver Island during herring season. Quotas grouped in-season to 8 units.	52	49
	South Coast - 10 management units	1,815	4,001,942	2,195	4,839,232			
	Inside - 7 units	387	875,356	547	1,205,950			
	West Coast - 3 units	1,418	3,126,586	1,648	3,633,282			
	Totals	2,801	6,176,000	2,704	5,961,405			
1982	Coastwide opening	2,948	6,500,000	3,135	6,910,800	With whole coast open, majority of landings came from south coast. Coast closure on September 1, 1982. Pearse Commission recommended a vessel quota and area licencing system.	52	53
1983	North Coast - 3 management units	907	1,999,830	502	1,107,051	Some areas open to December 31, Return to management units. Introduction of vessel G licence, transferable to a vessel of equal or shorter length. Grading introduced by processors - problems with product dumping on the fishing grounds.	54	53
	South Coast - 2 management units	2,041	4,500,170	2,134	4,706,068			
	Inside - 1 unit	454	1,001,018	481	1,060,740			
	West Coast - 1 unit	1,587	3,499,152	1,653	3,645,329			
	Totals	2,948	6,500,000	2,636	5,810,913			
1984	North Coast - 3 management units	907	2,000,067	575	1,267,255	Catch and effort increased. Exploratory areas opened in winter to maintain year round fishery. Vessel processing licenced.	54	44
	South Coast - 12 management units	2,086	4,599,933	2,909	6,411,210			
	Inside - 6 units	680	1,499,499	1,175	2,589,609			
	West Coast - 6 units	1,406	3,100,434	1,734	3,821,601			
	Totals	2,993	6,600,000	3,484	7,678,465			

Table 2.1.2. continued

Year	Management Units Areas	Quota (tonnes)	Quota (pounds)	Landings[a,b] (tonnes)	Landings[a,b] (pounds)	Management	Eligible Licences	Vessels Fished
1985	North Coast - 4 management units	907	2,000,286	1,436	3,165,786	Openings were set to maintain a year round supply of	55	52
	South Coast - 19 management units	2,063	4,549,714	3,934	8,672,839	geoducks for live markets. Several exploratory quotas set.		
	Inside - 10 units	748	1,649,630	1,055	2,325,839			
	West Coast - 9 units	1,315	2,900,084	2,878	6,344,787			
	Totals	2,970	6,550,000	5,370	11,838,624			
1986	North Coast - 11 management units	1,474	3,249,837	1,692	3,730,647	South coast quotas increased. North coast quotas	55	55
	South Coast - 22 management units	2,506	5,525,163	3,313	7,304,749	1.5 million pounds.		
	Inside - 11 units	919	2,026,187	1,119	2,467,254			
	West Coast - 11 units	1,588	3,501,181	2,194	4,837,494			
	Totals	3,980	8,775,000	5,005	11,035,396			
1987	North Coast - 16 management units	1,608	3,545,720	2,148	4,735,450	Quotas increased coastwide based on new grounds and	55	56
	South Coast - 27 management units	2,630	5,799,280	3,587	7,907,848	exploratory fisheries. All north coast quotas taken		
	Inside - 13 units	838	1,850,037	1,448	3,192,240	for the first time.		
	West Coast - 14 units	1,792	3,951,449	2,139	4,715,608			
	Totals	4,238	9,345,000	5,735	12,643,298			
1988	North Coast - 16 management units	1,576	3,475,000	2,026	4,466,707	South coast quotas reduced by 700,000 lb. Quotas	55	56
	South Coast - 27 management units	2,314	5,100,000	2,541	5,602,123	calculated from log book data, some exploratory fishing.		
	Inside - 11 units	794	1,750,000	995	2,193,689			
	West Coast - 16 units	1,520	3,350,000	1,546	3,408,454			
	Totals	3,890	8,575,000	4,567	10,068,830			
	FIRST THREE YEAR ROTATION							
1989	North Coast - 7 management units	1,597	3,520,441	1,600	3,526,040	First year of trial I.Q. Coastwide quota divided equally	55	47
	South Coast - 9 management units	2,395	5,279,559	2,386	5,258,207	among 55 licences; 160,000 lb. Area licensing: 12 inside		
	Inside - 4 units	871	1,920,040	870	1,917,284	south, 21 west coast Vancouver Is., 22 north coast		
	West Coast - 5 units	1,524	3,359,519	1,516	3,340,923	licences. Three year area rotation initiated.		
	Totals	3,992	8,800,000	3,986	8,784,247			
1990	North Coast - 5 management units	1,597	3,520,441	1,596	3,518,932	Second year of trial I.Q. 160,000 lb/licence.	55	46
	South Coast - 13 management units	2,395	5,279,559	2,360	5,203,434	Year two of the three year area rotation.		
	Inside - 5 units	871	1,920,040	864	1,904,986			
	West Coast - 8 units	1,524	3,359,519	1,497	3,300,553			
	Totals	3,992	8,800,000	3,956	8,722,366			
1991	North Coast - 19 management units	1,347	2,970,441	1,327	2,925,079	Third year of I.Q. 135,000 lb/licence (15.6% reduction)	55	47
	South Coast - 22 management units	2,020	4,454,559	2,006	4,421,785	Year three of the three year area rotation.		
	Inside - 10 units	735	1,620,842	734	1,617,941			
	West Coast - 12 units	1,286	2,835,922	1,272	2,803,844			
	Totals	3,367	7,425,000	3,333	7,346,864			

Table 2.1.2. continued

Year	Management Units Areas	Quota (tonnes)	Quota (pounds)	Landings[1,2] (tonnes)	Landings[1,2] (pounds)	Management	Eligible Licences	Vessels Fished
	SECOND THREE YEAR ROTATION							
1992	North Coast - 24 management units	1,197	2,638,689	1,199	2,643,221	Year one of second area rotation. I.Q. 114,750 lb/licence.	55	45
	South Coast - 37 management units	1,666	3,672,561	1,665	3,670,527	(15% reduction) 23 licenses North, 12 Inside South, 20 WC		
	Inside - 16 units	625	1,377,762	625	1,377,826	Vancouver Is.		
	West Coast - 21 units	1,041	2,294,800	1,040	2,292,702			
	Totals	2,863	6,311,250	2,864	6,313,748			
1993	North Coast - 27 management units	1,061	2,339,479	1,063	2,343,238	Second year of second area rotation. I.Q. 97,500 lb/licence.	55	44
	South Coast - 20 management units	1,371	3,023,021	1,371	3,022,182	(15% reduction) 24 licences North; 12 Inside South; 19 W.C.		
	Inside - 7 units	507	1,117,922	531	1,170,517	Vancouver Is.		
	West Coast - 13 units	840	1,852,179	840	1,851,665			
	Totals	2,432	5,362,500	2,434	5,365,420			
1994	North Coast - 32 management units	1,102	2,429,800	1,091	2,404,669	Third year of second area rotation. I.Q. 90,000 lb./licence	55	45
	South Coast - 30 management units	1,143	2,520,200	1,136	2,503,854	(7.7% reduction) 27 licences North, 10 Inside South; 18 W.C.		
	Inside - 15 units	408	899,599	408	899,271	Vancouver.Is.		
	West Coast - 15 units	735	1,620,601	728	1,604,582			
	Totals	2,245	4,950,000	2,227	4,908,523			
	THIRD THREE YEAR ROTATION							
1995	North Coast - 38 management units	1,144	2,520,199	1,145	2,524,968	Year 1 of the third area rotation. I.Q. 84,030 lb/licence	55	44
	South Coast - 41 management units	953	2,100,349	952	2,099,362	(6.9% reduction) 30 licences North, 11 Inside South; 14		
	Inside - 16 units	419	923,448	419	923,964	W.C.Vancouver Is.		
	West Coast - 25 units	534	1,176,901	533	1,175,378			
	Totals	2,097	4,621,650	2,097	4,624,330			
1996	North Coast - 43 management units	1038	2,287,243	1038	2,287,836	Year 2 of the third area rotation. I.Q. 73,785 lb/license		
	South Coast - 26 management units	803	1,770,932	804	1,772,081	(13.9% reduction) 31 licenses North, 13 Inside South; 11	55	47
	Inside - 10 units	435	959,209	436	960,979	W.C. Vancouver Is.		
	West Coast - 16 units	368	811,723	368	811,102			
	Totals	1841	4,058,175	1842	4,059,917			
1997	North Coast - 50 management units	947	2,087,960	947	2,088,004	Year 3 of the third area rotation. I.Q. 72,000 lb/license		
	South Coast - 37 management units	849	1,872,040	849	1,872,079	(2.5% reduction) 29 licenses North, 9 Inside South; 17	55	42
	Inside - 16 units	294	647,960	294	647,994	W.C. Vancouver Is.		
	West Coast - 21 units	555	1,224,080	555	1,224,086			
	Totals	1796	3,960,000	1796	3,960,083			

[1] Reported landings from sales slip submissions. 1969 to 1997 landings are I.Q. validated weights.

[2]There are minor differences between this Table and Table 2.1.1 due to rounding.

Table 2.1.3. Summary of geoduck quotas in lb with kg in [brackets] and rotation of areas for 1989 to 1997, and proposed fishing areas and quotas for the 1998 fishery.

Year	Inside Waters Areas	Inside Waters Quota (Vessels)	West Coast V.I. Areas	West Coast V.I. Quota (Vessels)	North Coast Areas	North Coast Quota (Vessels)	Annual Quota Total	Annual I.V.Q.
First Rotation (1989-1990-1991)								
1989	11, 12, 13	1,920,000 (12) [870,748 kg]	23, 24, 27A	3,360,000 (21) [1,523,810 kg]	lower 6, 7 to 10	3,520,000 (22) [1,596,372 kg]	8,800,000 [3,990,930 kg]	160,000 [72,562 kg]
1990	14, 16	1,920,000 (12) [870,748 kg]	24, 26, 27H, 27I	3,360,000 (21) [1,523,810 kg]	3, 4, 5, upper 6	3,520,000 (22) [1,596,372 kg]	8,800,000 [3,990,930 kg]	160,000 [72,562 kg]
1991	15, 17, 18, 19, 29-5	1,620,000 (12) [734,694 kg]	20, 24, 25, 26B1 26B2, 26C	2,835,000 (21) [1,285,714 kg]	1, 2E, 2W	2,970,000 (22) [1,346,939 kg]	7,425,000 [3,367,347 kg]	135,000 [61,224 kg]
Second Rotation (1992-1993-1994)								
1992	12, 13, 14A, 14B, 14C	1,377,000 (12) [624,490 kg]	23, 24A, 24A2, 24A3, 24B, 24B2 24B3, 27A, 27B, 27D, 27E, 27F, 27G, 27H, 27I	2,295,000 (20) [1,040,816 kg]	lower 6, 7 to 10	2,639,250 (23) [1,196,939 kg]	6,311,250 [2,862,245 kg]	114,750 [52,041 kg]
1993	14D, 14E, 16	1,170,000 (12) [530,612 kg]	24A, 24A2, 24A3, 24B, 24B2, 24B4, 26A, 26B2, 26D, 27H	1,852,500 (19) [840,136 kg]	3, 4, 5, upper 6	2,340,000 (24) [1,061,224 kg]	5,362,500 [2,431,973 kg]	97,500 [44,218 kg]
1994	15A, 15B, 15C 15D, 15E, 15F, 15G, 17A, 17B, 18A, 18B, 19A, 19B, 19C, 29-4 29-5	900,000 (10) [408,163 kg]	24A2,24A3,24A4,24A5 24A6,24B1,24B2,24B3, 24B4, 25A, 25B, 25C, 25D	1,620,000 (18) [734,694 kg]	1, 2E, 2W	2,430,000 (27) [1,102,041 kg]	4,950,000 [2,244,898 kg]	90,000 [40,816 kg]
Third Rotation (1995-1996-1997)								
1995	12A, 12C, 12D, 12F, 12G 13A,13C,13D,13E 14A, 14B, 14C	924,330 (11) [419,197 kg]	23A,23B,23C,23D,23E 24A2,24A3,24A4,24A5 24B1,24B2,24B3,24B4 24C 27A,27B,27C,27D,27E, 27G,27H,27I	1,176,420 (14) [533,524 kg]	lower 6, 7 to 10	2,520,900 (30) [1,143,265 kg]	4,621,650 [2,095,986 kg]	84,030 [38,109 kg]
1996	12B1, 12B2 14D, 14E 16A, 16B, 16C, 16D 16E, 16F	959,205 (13) [435,014 kg]	24A2, 24A3, 24A4 24A5, 24A6, 24B1 24B2, 24B3, 24B4 24C1, 24C2, 24D1 26A, 26B, 26C, 26D	811,635 (11) [368,088 kg]	3, 4, 5, upper 6	2,287,335 (31) [1,037,340 kg]	4,058,175 [1,840,442 kg]	73,785 [33,483 kg]
1997	13A, 13B, 13C, 13D 15A, 15B, 15C1, 15C2 15D, 15E, 15F, 15G 15H, 15I 18A, 18B 19A, 19B, 19C	648,000 (9) [293,878 kg]	24A2a, 24A2b, 24A3 24A4, 24A5, 24A6a 24A6b, 24B1, 24B2 24B3, 24B4, 24C1 24C2, 24D1, 24D2 25A, 25B, 25C, 25D	1,224,000 (17) [555,102 kg]	1, 2E, 2W	2,088,000 (29) [946,939 kg]	3,960,000 [1,795,918 kg]	72,000 [32,653 kg]
Fourth Rotation (1998-1999-2000)								
1998	12A, 12B3, 12C, 12D, 12E, 12G 13E 14A1, 14A2, 14B, 14C 17A1, 17A2, 17A3, 17B 29	648,000 (9) [293,878 kg]	23A, 23B, 23C, 23D 23E 24A2a, 24A2b, 24A4, 24A6a, 24A6b, 24B1, 24B2, 24B3, 24B4, 24D2 27A, 27B, 27C, 27D, 27H, 27I	1,080,000 (15) [489,796 kg]	lower 6, 7 to 10	2,232,000 (31) [1,012,245 kg]	3,960,000 [1,795,918 kg]	72,000 [32,653 kg]

Table 2.1.4. Openings and closures for geoducks in 1997 including reasons for management action. Also included are the Opening/Closure notice numbers (OC#).

AREA	GMA	OPEN DATE	CLOSE DATE	REASON FOR MGMT. ACTION	OC #	ISSUANCE DATE
24	ALL	01-Jan		As scheduled	N/A	N/A
15	E	7-Jan		As scheduled	5	6-Jan
	D			"		
	C2			"		
	I			"		
15	C1	2-Jan		As scheduled	9	9-Jan
	G			"		
2	QCA9	2-Jan		As scheduled	N/A	13-Dec-96
2	QCA10	2-Jan		As scheduled	N/A	13-Dec-96
15	E		13-Jan	Quota achieved	10	13-Jan
24	A2A		13-Jan	Quota achieved	11	13-Jan
	A4			"		
	A6			"		
	A6A	13-Jan		Fleet moves to these areas		
	B4			"		
	A2B			"		
25	D	2-Jan		As scheduled		
24	A5	16-Jan		Fleet moves to these areas	17	15-Jan
	B3			"		
	D2			"		
2	QCA10		27-Jan	Quota achieved	33	27-Jan
25	A	7-Feb		As scheduled	46	5-Feb
2	QCA2	7-Feb		As scheduled	47	5-Feb
	QCA3			"		
	QCA4			"		
	QCA5			"		
	QCA6			"		
	QCA7			"		
	QCA8			"		
2	QCA8		10-Feb	Quota achieved	56	10-Feb
2	QCA9		10-Feb	Quota achieved	57	10-Feb
25	D		12-Feb	Quota achieved	60	12-Feb
24	B4			"		
25	A	12-Feb		Fleet moves to area		
2	QCA5		21-Feb	Quota achieved	71	21-Feb
	QCA6			"		
	QCA7			"		
24	C1	24-Feb		Fleet moves to area	74	24-Feb
	B1			"		
2	QCA2		01-Mar	Quota achieved	96	3-Mar
	QCB2			"		
	QCB4			"		
	QCB5			"		
	QCB6			"		
	QCB7			"		
	QCB8			"		
	QCB9			"		
	QCB10			"		
2	QCA3		24-Mar	Quota achieved	155	24-Mar
	QCA4			"		

Table 2.1.4. (Cont.)

AREA	GMA	OPEN DATE	CLOSE DATE	REASON FOR MGMT. ACTION	OC #	ISSUANCE DATE
2	QCB3 QCB4 QCB5 QCB6 QCB7		19-Mar	Temporary PSP closure " " " "	156	24 Mat
15	C2		02-Apr	Quota achieved	179	2-Apr
2	QCB1		03-Apr	Quota achieved	183	2-Apr
2	QCB3 QCB4 QCB5 QCB6 QCB7	4-Apr		Reopen after PSP closure " " " "	189	4-Apr
15	C1 F G	5-Apr		Reopened to finish quota " "	192	4-Apr
2	QCB2 QCB3		08-Apr	Quota achieved "	202	8-Apr
25	B	16-Apr		As scheduled	219	14-Apr
24	C1	18-Apr		Fleet moves to area	226	16-Apr
2	QCB5		18-Apr	Quota achieved	230	18-Apr
2	QCC1 QCC2 QCC3 QCC4	25-Apr		As scheduled " " "	240	24-Apr
25	A		03-May	Quota achieved	260	2-May
2	QCB7 QCB9		07-May	Quota achieved "	270	8-May
2	QCB4		24-Apr	Quota achieved	N/A	12-May
2	QCC1		12-May	Quota achieved	275	12-May
2	QCB6		13-May	Quota achieved	281	13-May
2	QCB8		20-May	Quota achieved	291	20-May
2	QCB10		23-May	Quota achieved	301	23-May
2	QCC2		27-May	Quota achieved	307	27-May
2	QCC5 QCC6	6-Jun		As scheduled "	319	4-Jun
2	QCC3		06-Jun	Amended by OC 332	327	6-Jun
2	QCC4 QCC5		17-Jun	Quota achieved "	347	18-Jun
2	QCD1 QCD2	26-Jun		As scheduled "	366	26-Jun
2	QCC6		04-Jul	Quota achieved	393	4-Jul
15	A B	9-Jul		As scheduled "	405	8-Jul
13	A C D	7-Aug		As scheduled " "	502	7-Aug
2	QCA1	23-Aug		As scheduled	553	22-Aug

Table 2.1.4. (Cont.)

AREA	GMA	OPEN DATE	CLOSE DATE	REASON FOR MGMT. ACTION	OC #	ISSUANCE DATE
13	A		22-Aug	Quota achieved		
	C			"		
	D			"		
25	B	21-Aug		As scheduled		
1	QCE1	26-Aug		As scheduled	569	26-Aug
	QCE2			"		
2	QCD1		02-Sep	Quota achieved	593	2-Sep
	QCD2			"		
	QCA1			"		
2	QCD11	5-Sep		As scheduled	604	4-Sep
	QCD9	8-Sep		"		
	QCD10			"		
1	QCE1		22-Sep	Quota achieved	N/A	22-Sep
	QCE2			"		
2	QCD11		22-Sep	Quota achieved	671	22-Sep
	QCD7	22-Sep		As scheduled		
	QCD8	22-Sep		"		
25	B	21-Aug		As scheduled	702	2-Oct
2	QCD10		03-Oct	Quota achieved	707	3-Oct
	QCD3	4-Oct		As scheduled		
	QCD4			"		
	QCD5			"		
	QCD6			"		
2	QCD9		06-Oct	Quota achieved	714	6-Oct
25	A	17-Oct		Reopened to finish quota	738	15-Oct
2	QCD6		16-Oct	Quota achieved	743	16-Oct
	QCD7			"		
	QCD8			"		
25	C	24-Oct		As scheduled	762	23-Oct
2	QCF1	29-Oct		As scheduled	780	27-Oct
25	A		04-Nov	Quota achieved	797	4-Nov
	C			"		
24	D2	4-Nov		Reopened to finish quota		
2	QCF1		10-Nov	Quota achieved	N/A	10-Nov
2	QCD5		14-Nov	Quota achieved	828	14-Nov
	QCD3			"		
	QCD4			"		
24	A5	17-Nov		Reopened to finish quota	830	18-Nov
	D2					
24	C1	22-Nov		Reopened to finish quota	843	21-Nov
2	QCF4	26-Nov		As scheduled	853	25-Nov
	QCF5			"		
WCVI	ALL		09-Dec	Quotas achieved	882	8-Dec
2	QCF4		08-Dec	Quotas achieved	883	8-Dec
	QCF5			"		
2	QCF6	10-Dec		As scheduled	888	9-Dec
	QCF7			"		
	QCB8			"		
2	QCF6		22-Dec	Quotas achieved	925	22-Dec
	QCF7		31-Dec	"		
	QCB8			"		

Note: Many of the WCVI areas (24 & 25) open as shown in this Table but are not 'formally' closed by an explicit Notice to Industry (OC). The areas are not fished, as there is no available quota and are 'formally' closed by a general notice (in this case OC 882, issued 8 Dec. 1997).

Table 2.1.5. Summary of geoduck landings (tonnes) by South Coast Management Area, as reported on sales slips (1976 to 1988) and on validation logs (1989 to 1997). A three year rotation of areas was initiated in 1989, with the exception of Area 24.

	SOUTH COAST MANAGEMENT AREAS																		
	East Coast Vancouver Island											West Coast Vancouver Island							Annual
Year	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27	111	Landings
1976				9.5			8.2		26.0											43.7
1977			14.0	9.2	77.0		137.0	1.7						6.0						244.9
1978			8.4	261.0	321.0	3.4	24.0	19.0	136.0			0.5	2.7	1.8	236.0	2.0				1015.8
1979		24.0	160.0	276.0	263.0	148.0	209.0	2.9	159.0					153.0	950.0	87.0	22.0	9.4		2463.3
1980			97.0	215.0	17.0	301.0	225.0	34.0	91.0			5.1		288.0	841.0	321.0	303.0			2738.1
1981			41.0	180.0	29.0	70.0	155.0	44.0	28.0			7.6		187.0	819.0	473.0	156.0	5.7		2195.3
1982		83.0	14.0	144.0	33.0	103.0	17.0	1.0	14.0			14.0		174.0	1218.0	366.0	726.0			2907.0
1983		16.0	29.0	340.0	29.0	42.0	13.0	2.0	9.8					84.0	1066.0	215.0	287.0	0.9		2133.7
1984	8.3	302.0	150.0	285.0	54.0	129.0	128.0	0.5	118.0					219.0	628.0	442.0	443.0	2.0		2906.8
1985	13.0	490.0	81.0	172.0	42.0	38.0	137.0	4.1	78.0					227.0	730.0	599.0	272.0	1050.0		3933.1
1986	21.0	212.0	148.0	200.0	137.0	117.0	136.0	13.0	124.0		11.0	96.0		231.0	803.0	450.0	226.0	388.0		3313.0
1987		275.0	112.0	286.0	98.0	159.0	265.0	103.0	50.0		100.0	40.0		247.0	661.0	552.0	398.0	241.0		3587.0
1988	62.0	290.0	51.0	191.0	59.0	95.0	110.0	2.2	116.0	1.4	17.0	49.0		192.0	633.0	187.0	206.0	279.0		2540.6
1989	5.0	662.0	203.0											538.0	633.0			345.0		2386.0
1990				605.4		258.3									539.5		614.0	343.2		2360.4
1991					258.4		181.0	36.8	244.2		13.7	1.3			416.0	702.3	152.8			2006.5
1992		256.0	78.0	290.5										255.4	479.0			305.9		1664.8
1993				349.2		182.0									497.0		220.0	124.0		1372.2
1994					181.0		134.0	20.0	64.0		10.0				232.0	496.0				1137.0
1995		80.0	54.0	282.0		3.0								129.0	188.0			210.0	6.0	952.0
1996		95.7		195.0	42.5	102.0									239.2		129.1			803.5
1997			47.5		241.2	5.3									162.0	393.2				849.2
1976 to 1997	109.3	2785.7	1287.9	4290.8	1882.1	1756.0	1879.2	284.2	1258.0	1.4	151.7	213.5	2.7	2932.2	11970.7	5285.5	4154.9	3304.1	6.0	43555.9

Inside Waters Total: 15,686 West Coast Total: 27,870

Table 2.1.6. Summary of geoduck landings (tonnes) by North Coast Management Area, as reported on sales slips (1980 to 1988), and on validation logs (1989 to 1997). A three year rotation of areas was initiated in 1989.

	NORTH COAST MANAGEMENT AREA												
Year	1	2E	2W	3	4	5	6	7	8	9	10	106	Annual Landings
1980		31			4					28	5		68
1981		11				84	6	370	18		20		509
1982								227					227
1983								202	299				501
1984		4		3		214	8	109	183	54			575
1985		341	213			291	60	494	37				1436
1986	7	254	325	120	125	323	24	392	2	103	17		1692
1987	137	391	179	134	95	287	484	222	91	11	117		2148
1988	119	462	45	77	150	191	423	309	250				2026
1989							149	1269	40		142		1600
1990				77	356	441	721						1596
1991	91	848	388										1327
1992							202	853	83	23	39		1199
1993				37	170	411	445						1063
1994	48	684	359										1091
1995		0.48					218	736	121	30	40		1145
1996				86	150	400	377					25	1038
1997	36	393	518										947
1976 to 1997	438	3418	2027	534	1050	2642	3116	5183	1124	249	380	25	20167

Table 2.1.7. Summary of geoduck landings (tonnes) by South Coast Management Areas in 1997 , as reported on validation logs.

	SOUTH COAST MANAGEMENT AREAS														
	East Coast V.I.											West C			
Month	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24
Jan					29.6										75.3
Feb					4.6										48.7
Mar					6.5										
Apr					19.0	5.3									
May					26.3										
June					16.9										2.4
July					81.4										
Aug			47.5		45.9										
Sept					11.1										
Oct															
Nov															31.5
Dec															4.1
Area Totals			47.5		241.2	5.3									162.0

Mainland and East Coast Vancouver Is.: 294

West Coast Vancouver Is.:

South Coast Total: 849

Table 2.1.8. Summary of geoduck landings (tonnes) by North Coast Management Areas in 1997, as reported on validation logs.

	NORTH COAST MANAGEMENT											Monthly
Month	1	2E	2W	3	4	5	6	7	8	9	10	Totals
Jan		32.1										32
Feb		95.3										95
Mar		133.8										134
Apr		108.1	0.6									109
May		23.5	40.3									64
June			81.5									81
July			3.3									3
Aug			30.0									30
Sept	36.4		71.7									108
Oct			90.0									90
Nov			87.1									87
Dec			113.4									113
Area Totals	36.4	392.8	518.0									947.1

Table 2.1.9. Summary of 1997 geoduck licence and area quota overages.

Licence Area	No. Licences	No. Licences Over Quota	No. Licences with overage 1 - 200 lbs. (1 - 45 kg)	No. Licences with overage 201 - 300 lbs (91 - 136 kg)	Area Remaining Quotas (lbs)	(kg)	% over/under
SOUTH COAST							
Inside Waters	9	1	1	0	-49	-22	<0.01% over
West Coast Vancouver Isl.	17	1	1	0	-41	-19	<0.01% over
NORTH COAST							
Central Coast	29	4	3	1	7	3	<0.01 under
COASTWIDE TOTAL	55	6	5*	1	(83)	(38)	<0.01% over

* All overages were less than 50 lb (23 kg).

Table 2.1.10. Numbers of 1997 'G' licences and fishing vessels, area quotas and landings for each geoduck licence area.

Licence Area	Statistical Areas Open	No. Licences	No. Vessels	Area Quota (lbs)	(kg)	Total Landings (lbs)	(kg)
SOUTH COAST							
Inside Waters	portions of Areas 13, 15, 16, 18 & 19 *	9	9	648,000	293,878	648,049	293,900
West Coast Vanvouver Isl.	portions of Areas 24 and 25	17	17	1,224,000	555,102	1,224,041	555,121
NORTH COAST							
Northern Coast	portions of Areas 1 & 2	29	21	2,088,000	946,939	2,087,993	946,936
COASTWIDE TOTAL		55	42**	3,960,000	1,795,918	3,960,083	1,795,956

* Purge fishing of experimental aquaculture sites occurred in Area 15 (North and South Savary Is.) and Area 16 (Texada Is.) by special permit. Purge fishing landings appear in Table 2.1.16.)

** The sum of the number of *licenses* fished in each licence area is greater than the total number of *vessels* that fished in that area as a number of vessels fished two licences. As well, the sum of the number of vessels fishing in each license area (47) is greater than the total number of vessels fishing coastwide (42) as several vessels fished in more than one license area.

Table 2.1.11. Geoduck bed closures (temporary and permanent) to 1997.

Stat Area	Sub Area	Bed Code	Description	Fishing Area (Ha)	Reason for Closure
INSIDE WATERS					
12	16	202	Hardy Bay	9	Contaminated
12	16	301	Beaver Harbour	43	Contaminated
12	16	404	E Thomas Pt - airport	12	First Nations
13	1	2101	Mittlenatch Island	12	Marine Park
13	3	401	Gowland Harbour	5	Marine Park
13	3	402	Gowland Island	4	Marine Park
13	15	1201	Mansons Landing	16	Contaminated
14	4	5301	Qualicum Beach (portion)	181	Contaminated
14	8	4 beds	Baynes Sound	73	Contam. risk
14	10	4601	Comox Bar (portion)	831	Contaminated
14	11	4705	Union Pt.	16	Contam. risk
15	1	701	Westview to Grief Pt	63	Contaminated
16	21	1501	Gillies Bay (portion)	66	Contaminated
17	6	7102	Boulder Point	27	Contaminated
17	17	6201	E. Mudge Island	77	DFO Research
17	17	105	Cordero Point	4	MPA
19	8	0201	Towner/Patricia Bay	88	Contaminated
19	8	0202	Coles Bay	11	Contaminated
			Total Inside Waters:	1538	
WEST COAST					
23	4	2301	S. Flemming	5	Barnfield Research
23	5	2102	Marble Cove	1	Barnfield Research
23	5	2302	NW Flemming	2	Barnfield Research
23	5	2303	NW Flemming	11	Barnfield Research
23	8	1201	S. Brabant-N. Peacock Ch.	5	Pacific Rim Park Reserve
23	8	1701	NE Clarke Is.	5	Pacific Rim Park Reserve
23	8	1702	E. Turret Is.	4	Pacific Rim Park Reserve
24	1	2101	Hesquiat Harbour	1	First Nations
24	6	0605	Whitesand Cove	42	Marine Park
24	6	1202	S. Robert Point	7	DFO Research
24	6	1203	Dunlap Is.	22	DFO Research
24	6	0806	Ahous Bay	13	Whale Sanctuary
26	7	0501	N. Checkaklis Is. - Bunsbys	33	Sea Otter Reserve
26	7	0502	Battle Bay - NW Bunsby Is.	8	Sea Otter Reserve
26	7	0503	West of Battle Bay	5	Sea Otter Reserve
26	7	0504	SW of Theodore Pt.	6	Sea Otter Reserve
26	7	0505	N.Acous Pen.- Cuttle Is.	29	Sea Otter Reserve
			Total W.C.V.I.:	199	
NORTH COAST					
2	1	2801	Skidigate Mission	95	First Nations
2	1	2803	Shingle Bay	43	Contaminated
2	13/16	401/402	Dolomite Narrows	20	Marine Park
7	25	0704	West Hunter Island	24	Contaminated
			Total North Coast.:	182	
TOTAL CLOSED AREA:				1919	

Table 2.1.12. Summary of 1997 Geoduck Exploratory / Observer Monitored Fisheries.

Location	Dates	Length of Monitoring (days)	Management Subareas	Vessels	Scheduled Activity	Observer Involved
NORTH COAST						
Virago Sound **E12**	Sept 5	1	1-3	Charlie Skiff Paul Anthony Seaworthy I	MS	J. Leaky
Hippa Island **D9**	Sept 25-26	2	2-87	Seaworthy I Terror Point All Seasons	MS	J. Leaky
Seal Inlet **D8**	Oct 3-4	2	2-82	All Seasons Aquastar Triton J	MS	J. Leaky
Kano Inlet **D5**	Oct 16	1	2-70	Aquastar Paul Anthony Triton J	MS	J. Leaky
INSIDE WATERS						
West Harwood Is **15H**	Jan 21, Mar 26-27 Apr 11, May 28	1	15-2	Bonnie May Coast Harvester II Ten Forward Silver Sea II West Wave	BV, MS	L. Stevens E. Rome
Cortes/Redonda Is. **15F**	May 7-8, 14	3	15-5	Bonnie May Ten Forward Silver Sea II West Wave	BV, MS	L. Stevens
East Hernando Is. **15C2**	Aug 5	1	15-3	ChiBoum Rondo Coast Harvester II Hideaway II West Wave Bonnie May	BV, MS	L. Stevens
S.W. Cortes Is. **13C**	Aug 19	1	13-15	Chi Boum	MS	J. Pielou
East Harwood Is. **15E**	Sept 4, 5, 8 & 9	1	15-2	Janola	BV, MS	L. Stevens
West Coast of Vancouver Island						
Ahousat **24B3**	Jan 21-22	4	24-6	Lionsgate White Pointer	BV, MS	J. Crabb
Lemmens Inlet **24A5**	Jan 23-25	3	24-9	Lionsgate White Pointer Puelche Full Nelson Lil' Trapper	BV	J. Crabb
Outside **24B1**	Feb 15-17, 22	4	24-6	Arrantide II White Pointer Lionsgate Liberty	BC, MS	G. Richards
Esperanza (Rolling Roadstead) **25A**	Oct 22-23	2	25-13	Arran Tide II Lionsgate	MS	S. Brook
Rosa Harbour **25C**	Oct 25	1	25-13	Slo-Mo Insidia Jessica Lee Arrantide II New Fisher Lionsgate	BV, MS	S. & K. Brook

*Activity Codes: BC = boundary compliance, BV = bed verification, MS = market sample

Table 2.1.13. Summary of 1997 Geoduck Surveys with DFO / UHA / AFS.

Survey Location	Stat Area	Date	Vessels	First Nations/ Third Party	UHA Biologist Present?
QCI					
Cumshewa Inlet	02-Mar	June, 1997	Terror Point	Haida	Y
North Coast					
Principe Channel	May-13	July, 1997	Terror Point	Lynn Lee	Y
Central Coast					
Anderson Is./ Laredo Channel	Jun-13	July,m 1997	Lionsgate	Kitasoo	Y
West Coast					
Millar Channel/ Yellow Bank	24-4, 24-6	May, 1997	Hideaway II	KTFC	Y

Table 2.1.14. Summary of 1997 Activities for DFO / UHA 5-10 Year Geoduck Research Projects.

Project Location	General Purpose	Dates	Vessel	1997 Activites
Ritchie Bay	Harvest Manipulation, Density, Growth, Survival, Recruitment, Enhancement	May 23 - 26	Arran Tide II	Maintenance, survey for density
Marina Island	Harvest Manipulation, Density, Growth, Survival, Recruitment	Sept 15-19	Silver Seas II	Maintenance, survey for density
Gabriola Island	Harvest Manipulation, Density, Growth, Survival, Recruitment, Enhancement	Sept 10-12, 22-24	Bonnie May	Maintenance, survey for density

M121

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Table 2.1.15. Summary of 1997 geoduck incident reports.

	REASON FOR ISSUING INCIDENT REPORT											
	Low Priority				Medium Priority				High Priority			
Port	Observer not advised of offload cancellation	Offload mixup	Rough seas: Geoduck shells broken in transit	No Validation/ Harvest log on board	Careless handling of product on packer	Purge fishing in closed area without observer	Trucking problems	Scale problems	Highgrading	Intentional overfishing GMA quota	Falsification of landing & harvest records	Total reports
Prince Rupert/Pt. Edward		1			1							2
Port Hardy			3*									3
Lund/Powell River		1		1								2
Gold River								1				1
Zeballos	1											1
Tofino									1	1	1	3
Vancouver												0
Total	1	2	3	1	1	3	2	2	1	1	1	18

* Two incidents (Apr 26 & June 6) involving 2 packers and 3 fishing vessels. A report was issued for each fishing vessel involved.
**One event involving 3 vessels. A report was issued for each of the vessels.

Table 2.1.16. 1997 Geoduck Landings from Purge Fishing Activites.

Purge Harvest Location	Dates	Vessels	Landings (lbs)	Landings (kg)	Deducted From '97 Quota Areas
Crescent Bay, Texada Isl.	April, 4 days	4 vessels	11,592	5,257	16-22
North Savary Is.	Apr, 3 days May, 3 days July, 21 days August, 2 days	7 vessels	21,843	9,906	15-2
South Savary Is.	May, 2 days June, 7 days July, 21 days August, 2 days	9 vessels	105,502	47,847	15-2
S.E. Marina Island	August, 1 day	4 vessels	3,673	1,666	13-15
S.W. Marina Island	August, 2 days	4 vessels	155	70	13-15
TOTAL			142,765	64,746	

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Prince Rupert/Pt. Edward		1			1							4
Port Hardy			3*									3
Lund/Westview		1		1		3**						5
Gold River								1				1
Zeballos	1											1
Tofino									1	1	1	3
Vancouver							1					1
Total	1	2	3	1	1	3	2	2	1	1	1	18

* Two incidents (Apr 26 & June 6) involving 2 packers and 3 fishing vessels. A report was issued for each fishing vessel involved.
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S.E. Marina Island	August, 1 day	4 vessels	3,673	1,666	13-15
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TOTAL			142,765	64,746	

2.2. Horse Clams - S. Heizer

2.2.1 Introduction

Harvesting horse clams is done through a limited entry fishery, available to the 55 holders of G licences. G licence holders may harvest horse clams and geoducks. Landings have been recorded since 1979. Less than half the fleet typically participates in this fishery (Table 2.2.1).

Two species of horse clams are taken: *Tresus capax* and *T. nuttallii*. The lack of markets for the processed necks and body meat has limited landings in this fishery. Since 1992, managers have restricted development of this fishery until appropriate stock assessments have been done. There is currently no market for live horse clams.

2.2.2 Biological and Fishery Management Options

The biological objective of this fishery is to limit the fishery until there is adequate stock assessment information for a directed fishery in the past. The management objectives are to limit the fishery to a harvest which is incidental to geoducks. This is accomplished by limiting harvest to areas and times of geoduck openings, by setting several precautionary quotas and by requiring landings to be validated.

Other objectives are to limit the fishery to the subtidal area >10 feet (3.05 m) below chart datum], to protect intertidal vegetation and habitats supporting herring spawn and to determine if significant declines in mean size are occurring (which could require effort restrictions).

2.2.3 Fishery Management Actions

The fishery is limited to the subtidal area. Harvesting must take place at least 10 feet (3.05 m) below chart datum as a condition of licence. This restriction was put in place to protect intertidal vegetation and habitats that support herring spawn. The Elbow Bank and Yellow Bank areas have been closed to the harvest of horse clams since 1988 to protect herring spawn habitat.

Catch ceilings have been imposed on Inside Waters and the West Coast of Vancouver Island (WCVI). In 1998, Area 12 is limited to 2205 lb. (1t), Area 13 to 2205 lb. (1t), Area 14 to 4405 lb. (2t), Area 17 to 2205 lb. (1t), Area 23 to 2205 lb. (1t), Area 24 to 11025 lb. (5t) and Area 27 to 2205 lb. (1t). These amounts are loosely based on historical catches i.e.: areas with historically high catches were limited to 11025 lb. (5t), areas with moderate catches to 4410 lb. (2t), and areas with low catches to 2205 lb. (1t). The north coast harvest is not limited by catch ceilings.

Management restrictions for this fishery limit the fishery to those areas open to geoducks. This allows for fishing in an area once every three years, with the exception of Area 24 which is open every year with a precautionary harvest limit of 11025 lb. (5t).

The G licence requires submission of harvest log data to document catch and effort in the fishery.

2.2.4 Catch and Effort

Table 2.2.1 presents a summary of landings from 1979 to 1997. In 1997 the effort of 140 boat days and landings of 16,400 lb. (7.46t), in 1997, were greater than the record low landings, in 1996, of 22 lb. (0.01t). The majority of landings were from Area 2 (E. side of Moresby Is.) a small amount from Area 1 (N. end of Graham Is.) and 390 lb. (0.18t) from the inside waters

(Table 2.2.2.). No product was landed on the WCVI .The price averaged $1.76 per kg ($0.80 per lb.). Landings by month for 1997 are shown in Table 2.2.3.

2.2.5 Stock Assessment Activities

No new stock assessment activities took place in 1997. A Phase 0 horse clam assessment paper was presented to PSARC in 1998.

2.2.6 Enforcement Concerns

Harvesting horse clams during closed periods or by unlicenced operators (poaching) is the main concern for enforcement personnel.

2.2.7 Priority Issues

The fishery has been limited to an incidental fishery, open only when the geoduck fishery is open. Horse clams have been opened and closed concurrently with geoducks since 1992. Obviously, this has reduced opportunities and landings in the fishery and is reflected in historical catches (Table 2.2.1.). Processors do not usually want horse clams when they are buying geoducks.

There continues to be concern about the impact of harvesting horse clams in eelgrass beds. In many areas, horse clams are found in the intertidal zone or shallow subtidal zone. The G license restricts harvesting to depths greater than 10 feet (3.05 m) below chart datum.

There is a small but growing interest in developing a directed fishery on horse clams. This interest is not reflected in the historical catches (Table 2.2.1.) since catch levels have been strongly curtailed by management actions rather than by interest in harvest or stock availability. Fishers maintain that a certain level of harvest must occur before there is a market interest, and that the constraint of non-directed fishery effectively precludes reaching this level.

Fishers have been informed that before the idea of a directed fishery can be entertained, basic productivity parameters (recruitment, growth, densities and bed sizes) will have to be determined at the expense of the industry. As well, there is some concern that fishers may harvest in eelgrass beds (either in violation of the harvest depth restriction or in beds which are less than 10 feet below chart datum). This concern will have to be addressed in advance of any directed fishery. To date, these concerns have acted as a deterrent to the development of this fishery.

Horse clams are taken incidentally to butterclam harvesting, in the intertidal zone, and are generally discarded where they have been taken. If a directed horse clam fishery prosecuted under authority of a G license is allowed, licensing (or other control) of the incidental harvest of horse clams in the butterclam fishery will have to be addressed.

Table 2.2.1. Horse clam landings (tonnes) and effort for British Columbia, 1979 to 1997, as reported on sales slips and harvest logs.

Year	Licences Issued	Vessels with Landings	Fishing Days	Total Landings (t)	Total Landings (lb)	Landed Value ($-10³)	Landed Value ($/t)	Landed Value ($/lb)
1979	G 101	N/A	N/A	37	81585	N/A	N/A	N/A
1980	G 95	28	N/A	128	282240	79	617	0.28
1981	G 52	12	N/A	51	112455	38	745	0.34
1982	G 52	40	N/A	321	707805	235	732	0.33
1983	G 54	8	N/A	21	46305	12	571	0.26
1984	G 54	5	N/A	6.7	14774	5.5	821	0.37
1985	G 55	7	N/A	6.3	13892	5.9	937	0.42
1986	G 55	15	193	96	211680	63	656	0.30
1987	G 55	27	471	355	782775	359	1011	0.46
1988	G 55	33	405	325	716625	300	923	0.42
1989	G 55	16	118	116	255780	144	1241	0.56
1990	G 55	22	254	124	273420	138	1113	0.50
1991	G 55	17	183	110	242550	119	1082	0.49
1992	G 55	2	8	2	3826	2	1088	0.49
1993	G 55	17	118	23	51081	49	2121	0.96
1994[2]	G 55	11	168	64	141120	111	1734	0.79
1995[2]	G 55	8	15	3	6615	3	1000	0.42
1996[2]	G 55	1	1	0.01	22	ND	ND	ND
1997[2,3]	G 55	12	140	7.46	16449	13	1764	0.80

N/A - data not available
ND - no data
[1] from sales slip data
[2] data from harvest logs
[3] preliminary data for 1997

Table 2.2.2. Summary of horse clam landings (tonnes) by management area from South Coast and North Coast areas, 1979 to 1997, as reported on sales slips or harvest logs.

	HORSE CLAM LANDINGS BY MANAGEMENT AREA (TONNES)																								
	North Coast								Inside Waters										West Coast V.I.							
Year	1	2E	4	5	6	7	8	Total N.C.	12	13	14	15	16	17	18	19	29	Total Inside	20	23	24	25	26	27	Total W.C.	Total Coast-wide Landings
1979										*	27	0.3	8.5	0.2		*		34.0				4.3			4.3	38.30
1980									0.1	0.5	22	46	50	9		*		127.6		0.4		*	*		0.4	128.00
1981									5.2	*	7.3	1.4	1.7	4.2		2.3		22.1		1.2	27.1	0.7			29.0	51.10
1982									3.1	0.3	163	0.3	2.6	14.8				184.1		2.3	123.6	3.4	6.8		135.9	320.00
1983											0.2		*					0.2		0.2	4.5	*	15.7		20.4	20.60
1984										3.9	2.3							6.2							0.0	6.20
1985											6		*	0.1				6.1					*		0.0	6.10
1986										23	67	0.9	0.2	2	3			96.1		*	0.2	0.2			0.4	98.50
1987		0.2						0.2	24	0.5	132	42	5.9	148	0.3	*	3.4	354.1	0.1	0.1	1.1				1.3	355.60
1988		0.7		0.1				0.8		14.4	57.7	0.3	0.2	77.1	4.9	1.5	5.3	170.4		7.3	140.7	0.9	4.2	1.2	154.3	325.50
1989						0.1		0.1	22.5	1.8	0.2		0.2	7.9		0.1		32.5		4.8	78.1			0.1	83.0	115.60
1990											29		6		*			35.0			90				90.0	125.00
1991			1					1.0				6.0		22.0				28.0			78.0	2.0			80.0	109.00
1992						1	1	2.0	0.2									0.2							0.0	2.20
1993											6.65		1.56					8.2			14.1			0.80	15.0	23.20
1994'		4.2						4.2				57.5		1.9				59.4				0.1			0.1	63.70
1995'					*	*	*	0.1			1.1							1.1			0.20				0.2	1.43
1996'					*			*										0.0							0.0	0.00
1997'	*	7.2						7.3				0.18						0.2							0.00	7.48
Area Totals		12.3	1.0	0.1	*	1.1	1.0	15.7	55.1	44.2	521.5	154.9	83.9	295.2	8.2	3.9	8.7	1185.5	0.1	16.3	567.6	11.6	26.5	2.0	914.3	1795.5

Data for 1979 to 1993 obtained from DFO records. Data for 1994-1997 from validation records and harvest
* landings less than 0.10 t.
' landings reported from harvest logs, other years landings are from sales

Table 2.2.3. Summary of horse clam landings (tonnes) by Management Area in 1997, as reported on validation logs.

	North Coast										South Coast	Monthly
Month	1	2	3	4	5	6	7	8	9	10	15	Totals
Jan		326									326	652
Feb		7732									62	7794
Mar		2959										2959
Apr		148										148
May		119										119
Jun												
Jul												
Aug												
Sep	153											153
Oct												
Nov		2045										2045
Dec		2566										2566
Area Totals	153	15895									388	16436

2.3. Scallop Dive and Trawl Fisheries - G. Parker, K. Marcus and G. Gillespie

2.3.1 Introduction

Two species of scallops, the spiny scallop (*Chlamys hastata)* and the pink scallop (*C. rubida)* are harvested in inshore waters by divers and by small drag nets. Both species attain a maximum size of not more than 80 mm and occur in small beds scattered along the coast of British Columbia (Bourne and Harbo 1987).

The depth distribution of the spiny scallop (*C. hastata)* is from the intertidal zone to 160 m on firm rock or gravel bottom, while pink scallops (*C. rubida)* occur from 1 m to 200 m on softer sand and mud bottom. *C. rubida* is not as abundant in the catches as *C. hastata.* Little is known of the population structure or the distribution and size of beds for either species. In previous years, it was determined that almost 100% of scallops caught by divers were spiny scallops, *C. hastata.* Sampling in Area 14 in 1986 (Harbo, DFO, unpublished), showed that up to 34% of the catch in dragging operations were pink scallops, *C. rubida,* but only 1% of these were of legal size, (55 mm shell height). Pink scallops tend to occur on softer bottom and in waters too deep to be easily harvested by divers. No recent catch sampling has been carried out in either dive or drag fisheries for scallops.

There has been limited culture of the Japanese scallop, *Mizuhopecten yessoensis* in B.C. since 1985, with approximately 27 t of farmed scallops marketed in 1996 for an estimated farm gate value of $172 K. Permits to trawl for weathervane scallops, *Patinopectin caurinus,* have been issued in the past, but a moratorium was placed on experimental fisheries in 1992 and no harvest has occurred since.

Pink and spiny scallops are marketed whole in the shell, fresh or frozen. The large adductor muscle or the adductor muscle attached to the gonad is eaten. Scallops are susceptible to contamination from both PSP and faecal coliforms and, by DFO regulation, must be landed at a registered shellfish plant prior marketing.

2.3.2 Biological Objectives

The biological objectives (see section 1.5.) are addressed by a minimum size limit of 55 mm shell height, measured perpendicular to the shell hinge. The size limit allows scallops to mature and spawn at least once before reaching legal size (Bourne and Harbo 1987).

2.3.3 Fishery Management Actions

The commercial fishery for pink and spiny scallops began in 1982, when a Z-I category licence was required to harvest pink and spiny scallops by either dive or drag (net) or dredge gear. Starting in 1993, a separate licence category (Z-R) was established for fishing with net gear.

A minimum size limit was set initially at 60 mm in 1982. After continued requests from fishers, and a limited survey and market sampling, the minimum size limit was reduced to 55 mm shell height in 1989. Minimum size limits have remained at 55 mm for *Chlamys* spp., measured through the longest diameter of the shell perpendicular to the hinge. An experimental licence is required for the harvest of weathervane scallops, with a minimum size limit of 120 mm.

The size of the drags used for fishing scallops has been limited to a maximum width of 2 metres. There are numerous small closures in park and study areas. At the request of dive harvesters, closures to net gear were set in 1993 in subareas 17-10, 29-4, 29-5, 18-1 19-5 and

19-6. These are areas most frequently harvested by dive fishers, who have the ability to harvest more selectively with less undersize mortality and no physical disruption to the grounds.

Both ZI and ZR licenced harvesters are required by conditions of licence to submit harvest logbook data (documenting detailed catch and effort) and copies of fish slips (documenting sale or other disposal of scallop catch) to Department of Fisheries and Oceans Canada (DFO).

In 1997, DFO closed area 29-5 to scallop fishing amidst reports of over-harvesting from Scallop by Dive fishers.

2.3.4 Catch and Effort

There were 38 Z-R (net gear) licences issued in 1997, which was a slight decrease from 40 licences in 1996 (Table 2.3.1). The number of ZI (dive) licences issued to harvest scallops by diving increased from 39 licences in 1996 to 41 in 1997. Landings were reported from only 8 diving (Z-I) vessels and 4 net (Z-R) vessels, in keeping with the trend in the scallop fisheries where many more licences are issued each year than actually report fishing activity or landings. Since 1991, less than 30% of the licences issued annually (ZI and ZR combined) report fishing activity during the licence year.

Preliminary reports from harvest logs indicate that coastwide landings of scallops were lower in 1997 than 1996, dropping to around 78 t. Total landed value also dropped to $376,000. The highest annual landings recorded to date were in 1994 at 106 t.

Most of the landings in 1997 were from the southern Strait of Georgia, from the combination of Pacific Fishery Management Areas 17 and 29, in which the scallop fishing grounds are in close geographic proximity (Table 2.3.2). Problems with PSP continue to limit the fishery in area 20, which had supported a significant portion of the net fishery in 1988 through 1990. Landings occurred throughout 1997, to provide a continuous supply of product to a relatively small market. Landed value averaged $4820 per tonne.

2.3.4.1 Scallop Dive Fishery

The scallop dive fishery is characterised by a small fleet of locally owned skiffs and small boats fishing in the waters of Georgia Strait. The dive fishery continued to provide most of the coastwide landings of scallops 1997 (Table 2.3.1). Diver CPUE (kg/diver hour) in each area has changed slightly from year to year, generally between 54 and 77 kg/diver-hr, but shows no clear trends. In 1997, CPUE was slightly less than in 1996 in most statistical areas.

A relatively small portion of the south coast has supported much of the dive fishery from at least the mid 1980's when harvest logs were introduced into the scallop fishery. An estimated 82% of the total scallop landings reported on fish slips from 1986 to 1997 were harvested in Areas 17, 18, 19 and 29 (Table 2.3.2).

Landings from six selected Subareas in Areas 17 and 29, which have close geographic proximity, account for 96% of the total scallop catch reported on fish slips for Areas 17 and 29. There are frequent discrepancies in the reported area of catch between harvest logs (which include reporting by Subarea and bed) and the Pacific Fishery Management Area reported on fish slips, in particular with Areas 17 and 29. It should be noted that landings reported as Subarea 29-5 on slips are often entered as Management Area 17.

In Area 18, 75% of the total catch has been reported from Subarea 18-1, with minor fishing in a number of other Subareas since 1986. Four Subareas in Area 19 have supported 79% of the total catch in Area 19.

2.3.4.2 Scallop Net Fishery

Dragging activity and landings decreased again in 1997 (Tables 2.3.1.) In 1997, 4 of the 38 licensed vessels reported a total catch of 4 t of scallops. Most of the catch by dragging operations in 1997 came from Area 14.

In the 1996 season, fishers report that access to markets rather than available stocks is the limiting factor in the scallop net fishery.

2.3.5 PSP Monitoring by Industry

Industry funded PSP (Paralytic Shellfish Poison) monitoring continued through 1996 and into 1997. Scallop dive fishers as a group voluntarily collect samples weekly from two mussel stations, at Porlier Pass and Active Pass, for testing by the Canadian Food Inspection Agency (CIFA). (Klaus Schallie, pers. comm.) This voluntary water quality monitoring provides sample coverage for subareas 17-3, 17-10, 18-1 and 29-5, where 68% of the total coastwide scallop landings have been reported during the period of 1986 to 1996. Approximately 95% of the coastwide landings from 1993 to 1996 have been reported from Areas 17, 18 and 29. Scallop samples are also regularly sent in by shellfish processing plants or collected by CIFA inspection officers for PSP and contamination analyses.

2.3.6 Stock Assessment Activities

The Shellfish Data Unit continued to collect and process harvest logbook information for scallop dive and trawl fisheries in 1997. All harvest log data for both net and dive fisheries has been error checked and converted to the new harvest log database format in MSACCESS. No new assessment activities or research were undertaken for scallops.

Commercial catches have not been sampled since 1986.

2.3.7 Enforcement Concerns

Enforcement concerns include harvest of undersized scallops, fishing in areas closed due to contamination or PSP, sales from other than a registered shellfish plant and dockside storage of catch.

2.3.8 Priority Issues

There is continued interest in the drag fishery, however landings and fishery participation remain lower than in the early 90s. This should be investigated to determine if these declines are from stock declines, market declines or a failure to report catch. Incidental reports from fishers in 1996 indicate that stocks are abundant but markets are limited.

There has been interest in experimenting with an Alaskan-style drag to fish weathervane scallops. Until recently, in 1996, there was a moratorium on experimental fisheries for invertebrates. New fishery proposals fall under the New and Developing Fishery Guidelines.

There is continued concern from Fish Inspection and D.O.E. that some areas where fishing takes place have not been classified as approved shellfish growing and harvesting areas, particularly in subtidal waters.

Managers have concerns that there may be localized overharvesting in some areas and have requested that analyses of catch over time from specific harvest sites be undertaken. Resource maps with bedcodes for scallop fishing areas reported on harvest logs were first developed in

1995. In order to undertake detailed analyses by bed, existing bed information must be verified and digitized, as well as historic logs examined and bedcodes inserted where possible.

References

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Table 2.3.1. Annual landings (tonnes), value and effort for pink and spiny scallops, 1982 to 1997, as reported on sales slips and harvest logs.

Year	Type and # of Licences Issued		Number of Vessels with Landings		Total Vessel Fishing Days		Coastwide Landings (t)	Dredge Gear Landings (t)	Dive Gear Landings (t)	Landed Value ($·10³)	Whole Landed Value ($/t)	Diver CPUE[2] (kg/diver hr)
	Dive	Trawl	Dive	Trawl	Dive	Trawl						
1982			8				8			19	2375	
1983	Z 11		6				11			24	2182	
1984	Z 17		13				18			56	3111	
1985	Z 22		13				53			291	5491	
1986	Z 24		15		481		68			212	3118	61
1987	ZI 29		10		592		68			244	3697	54
1988	ZI 17		15		905		67			286	4269	118[4]
1989	ZI 43		15		777		77	37	40	316	4104	65
1990	ZI 57		11		367		69	10	59	317	4594	77
1991	ZI 61		9	12	481	189	82	23	59	387	4700	58
1992	ZI 83		7	11	471	205	91	19	72	420	4638	58
1993	ZI 35	ZR 44	10	8	703	82	90	8	82	422	4684	73
1994	ZI 37	ZR 32	15	4	767	63	106	5	101	504	4755	68
1995*	ZI 29	ZR 43	14	8	617	99	93	9	84	462	4968	73
1996*	ZI 39	ZR 40	12	4	827	78	102	7	95	493	4833	67
1997*	ZI 41	ZR 38	8	4	464	66	78	4	74	376	4820	58

[1] from sales slip data
[2] CPUE [ ] from harvest log data - log format changed in 1988
* preliminary data for 1995, 1996 and 1997

Table 2.3.2. Annual landings (tonnes) of pink and spiny scallops by management area, 1982 to 1997, as reported on fish slips.

	East Coast Vancouver Island											West Coast Vancouver Island						
Year	10	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	27	Total
1982				0.1	*			0.1	2.9			4.8		0.2				8.1
1983							0.3	8.3	2.2			0.2						11.0
1984	3.6		*	1.1			0.3	15.1										20.0
1985	0.3			4.1				47.7	0.9		0.3							53.3
1986	0.0			12.7		0.1	18.3	20.3	2.4		13.8	*						67.6
1987		0.7	1.5	0.4	0.1	0.2	24.9	26.4	0.5	0.2	10.7		0.2			0.3		66.1
1988			*	3.9			19.5	22.8	2.8		6.9	10.7	0.3				0.1	67.1
1989			0.1	*			16.0	19.8	0.5	0.1	2.4	35.8		0.1		0.1	*	74.9
1990				0.2			30.4	28.4			0.3	9.4						68.7
1991			*	19.6		0.2	27.8	29.1	0.3		0.7	2.6			2.0			82.2
1992				18.1		0.4	38.6	23.1	0.1		8.5				1.8			90.6
1993			1.0	5.5		0.4	53.3	17.5	0.4		9.6	2.0				0.2		89.8
1994		0.3	1.6	3.6		0.5	59.8	20.1	2.9		13.9	0.1				1.0		103.8
1995			4.1	5.5		0.2	64.4	7.4	2.3		10.8	1.3		*				96.1
1996**		*	2.2	4.9	1.3	0.7	50.4	41.0			1.5							102.0
1997**	0.1		0.1	4.3	0.6	2.4	6.2	29.9			29.0							72.6
Totals	4.0	1.0	10.6	83.8	2.0	5.1	410.3	357.1	18.1	0.4	108.5	66.8	0.5	0.3	3.7	1.6	0.1	1073.8
%	0.4%	0%	1%	8%	0%	0%	38%	33%	2%	0%	10%	6%	0%	0%	0%	0%	0%	

* Less than 100 kg
** Preliminary

2.4. Intertidal Clams - R. Webb

2.4.1 Introduction

Over 400 species of bivalves are found along the coast of British Columbia, but only a few are commercially or recreationally harvested. Four species of intertidal clams; butter, littleneck, Manila, and razor clams (Table 2.4.1.) comprise the major portion of landings in commercial and recreational fisheries. A few other species occasionally enter the commercial fishery and are utilized to a somewhat greater extent in the recreational fishery. The Manila clam was accidentally introduced in the 1930's with oyster seed from Japan. It is currently the most important species, comprising over 70% of intertidal clam landings.

Another recently introduced Japanese species has been reported in increasing numbers since the early 1990's. The varnish clam *(Nuttallia obscurata)* has been reported from beaches in Puget Sound, Sooke and as far north as Manson's Landing on Cortes Island. Sightings have been recorded in 1997 from Barkley Sound on the West Coast of Vancouver Island. A huge increase in varnish clams at Savary Island has been noted between clam surveys undertaken in 1995 and 1998 (G. Gillespie, pers comm).

Historically, First Nations on the west coast of Canada utilized clams as a source of food. They were also important to early settlers. Fishing methods have not changed appreciably since white explorers first came to the coast. The equipment used is simple and inexpensive; it includes some type of transportation to a clam beach, a lantern (since much commercial digging occurs in the fall and winter when low tides occur in darkness), a fork, rake or shovel, and a sack. Hydraulic or mechanical harvesting gear is prohibited. Diggers usually arrive at the beach 3 to 4 hours before low tide and work for a similar period after low tide. The location of beaches with clam densities that will support commercial digging is largely a matter of local knowledge but an indication of clam density can frequently be obtained from the type of bottom, presence or absence of siphon holes or squirting clams, and by test digging.

Although the intertidal clam fishery is small in relation to many other British Columbia fisheries, it is important to coastal communities and provides needed employment to many people. Furthermore, intertidal clams are widely used in the recreational fishery.

Although the commercial clam fishery began just before the turn of the century, landings were not reliably recorded until 1951. Since 1971, strong markets and higher prices for littleneck and Manila clams have focused the intertidal fishery on these two species. The landings of butter clams, which enter the market as a canned product, had been declining because of the high cost of processing and a shift in demand toward fresh steamer clams. However, efforts have been made in the past two years to reactivate the butter clam fishery.

From 1984 to 1988, clam landings increased steadily, largely owing to strong markets in the United States. The increased landings mainly consisted of increases in Manila clam landings; there was only a minor increase in landings of native littleneck clams.

Fisheries and Oceans Canada (DFO) has compiled an inventory of clam beaches reported in the south coast of British Columbia (Harbo et.al. 1997 a, b, c), in an attempt to assess where clams are harvested by First Nations for food, by commercial and recreational fishers. In the South Coast, over 1000 beaches have been identified: at least 664 beaches are used for commercial digging, 636 beaches have reported recreational use, and at least 216 beaches are regularly used for food fishing by First Nations. A large number of these beaches can be accessed by road or small vessels and many are now harvested by all user groups. It is also important to note that beaches under contaminated closures are not fully represented in the above clam beach inventory, as much of the data was collected prior to the development of

depuration harvest techniques, when clams contaminated with faecal coliform were not considered part of the harvestable resource. Beaches used historically by First Nations for food, social and ceremonial harvesting are not fully represented, nor are many small "pocket" beaches with relatively small populations of clams, once thought to be of little importance but that are now routinely harvested due to strong market demand and many diggers. The estimate of the total area of known beaches is 9334 hectares (Harbo et al, 1997), however indications from recent surveys in a number of areas suggest that only 30% of the measured beach area may be 'clam bearing'.

Most of the north coast is closed to the harvest of all intertidal clams, with the exception of razor clams, due to the fact that funding shortfalls limit Paralytic Shellfish Poisoning (PSP) monitoring programs as well as Department of Environment water quality monitoring. Clam beaches in the central coast area were inventoried in 1990 through 1993 (Bourne et al 1992, 1994) as well as in 1994 and 1996 (Heritage et al in prep.) in order to assess commercial fishery potential. A commercial communal fishery for Manila clams commenced in the Bella Bella area in 1992 under an agreement with the Heltsiuk First Nation through the Aboriginal Fishery Strategy (AFS) program.

2.4.2 Biological Objectives

In the conventional commercial fishery the biological objectives (section 1.5.) are addressed by a minimum size limit which allows clams to spawn at least once before reaching harvestable size. For depuration and First Nation pilot fisheries, which are managed in a more conservative manner than the conventional fishery, total allowable catch (TAC's), expressed as a proportion of the available legal-size stock, are used.

2.4.3 Fishery Management Actions

The commercial clam fishery has been managed as a common property fishery with licence holders competing each season for a share of the harvest. Share competition does not create an incentive to properly husband or enhance the resource.

The increased level of clam harvest effort in the past five years has resulted in very short and intensive fisheries. The fishery has also become less lucrative on an individual basis and harvesters, processors and First Nations peoples are calling for changes to management of this fishery. A joint federal / provincial review of clam management has taken place with all client groups and significant changes have been implemented in the fishery since January 1989.

A variety of regulatory controls have been put in place to support management objectives. The regulatory controls are intended to restrain the commercial harvesting efforts to the point where a sustainable harvest can be achieved.

Historically, the intertidal clam fishery has been a loosely regulated fishery in terms of licensing. Prior to 1989, there are only estimates regarding the number of clam harvesters, because there was no unique commercial clam licence. Any holder of a Fishers Registration Card (FRC) was entitled to harvest clams. Since all commercial fishers are required to have FRC's, it was difficult to determine how many individuals exercised the privilege of commercial clam digging. Likewise, there are no estimates of participation in recreational fisheries

In May 1989, a commercial clam licence was introduced with Area licensing restrictions. The South Coast was divided into 6 "areas" and fishers had to choose to fish one of these six licence areas (Figure 2.4.1). In 1992, an additional licence area was created, Area G, Queen Charlotte Sound, which was previously contained within Area B. The fishery is substantially over subscribed in all licence areas. In 1997, 1572 licences were issued which is down somewhat from 1996 (1906 issued) (Table 2.4.1).

The main conservation tool utilized in this fishery is a minimum size limit. Until 1966, there was both a seasonal restriction to harvesting butter, littleneck and Manila clams, and a minimum size limit in both commercial and recreational fisheries: 63 mm shell length for butter clams and 38 mm for littleneck and Manila clams. The razor clam minimum size is 90 mm. Currently, in the recreational fishery there is no size limit but rather a daily quota and the fishery is open year round except for PSP or contamination closures.

The minimum size limit and short seasons are currently the key management tools for this commercial fishery. The size limit was retained for the commercial fishery but was replaced by a daily limit in the recreational fishery. Both seasonal closures and the size limit were retained in the commercial razor clam fishery. Application of a minimum size limit ensures that clams become sexually mature and can spawn at least once before they can be legally harvested.

In 1988, due to concerns of over harvesting, it became necessary to eliminate a year round fishery and reduce opening times in some areas to either a shortened season or a reduced fishing week. In 1989, there were further reductions in fishing times, coupled with staggered area openings and area licensing restrictions in an attempt to maintain a continuous market supply. Under current regulations, the fisheries are opened for seasons in consultation with industry, subject to closures for PSP or faecal coliform contamination.

Since 1990, in-season monitoring has played a key role in active management of the fishery. When catch per digger per tide begins to fall dramatically, and reduced numbers of legal sized clams become available, beaches are closed to commercial harvest. In 1991 through 1997, fishery openings became even shorter, down to one or two days, every week or ten days, in most areas, with fisheries lasting only one to two months of the year. During the fishing season, meetings or telephone consultations are held with industry representatives in each area to determine the strategic sequence of fishery openings and closures.

In 1992, DFO and the Provincial Ministry of Agriculture, Fisheries and Food (MAFF) initiated a public consultative process on the issue of clam fishery management and solicited suggestions on how to improve the fishery (Clam Reform). As a way of pursuing Clam Reform, a pilot project involving community management and limited entry licencing was undertaken in the Powell River Area (Area "C") in 1994. This initiative was implemented in order to allow a limited harvest of available clams from Savary Island, which had been closed since 1989 because of conservation concerns. It was decided that an open fishery would be unacceptable and that this area in general was a good place to pilot a community management project.

A "management board" was struck with 3 participants from the First Nations community and 3 non-First Nations harvesters as well as a DFO representative. This board acted in an advisory capacity to develop the appeal criteria and the fishing plan for the year. The intent of the board was to assume more responsibility over time.

This pilot has been successful to the degree that there is an increased feeling of stakeholder responsibility and interest among the licensed individuals. These individuals have seen a much higher economic benefit than before and this economic gain is reflected in the local community. The program continued as a pilot in 1997 and will become permanent under Clam Reform in 1998.

2.4.4 Fishery Management Issues

2.4.4.1 Open Commercial Fisheries

2.4.4.1.1 Clam Reform

This report provides information for the 1997 fishery. The 1997 fishery was prosecuted as an "open" fishery similar to past years and subject to the same complaints and issues as in past years. In 1998, the process of Clam Reform has been implemented. This fishery is now a limited fishery with significant reductions in effort. Furthermore, the Department has undertaken to develop Community Management Boards for the clam fishery in Area "F" (WCVI) and Area "C" (Sunshine Coast) Attempts at structuring similar boards in Area "G" and "E" have been met with some resistance and are presently on hold. Significant gains have been made in the fishery as a result of this clam reform initiative. The most obvious gain has been a reduction in the amount of diggers (approximately 50% of recent years). This means that there are fewer harvesters in each area and therefore more fishing days available. Accordingly, the harvesters have seen a greater economic benefit and hopefully will see themselves as stakeholders in the clam resource with improved management and enforcement. The community management boards will, over time, have some opportunity for increased responsibilities and input. First Nations play a significant role in the commercial fishery both in terms commercial licenses and in pilot projects. Under this Clam Reform initiative there are opportunities for First Nations to participate in the commercial fishery as well as co-manage beaches fronting or immediately adjacent to First Nations reserves.

2.4.4.1.2 Short Fishing Seasons and Reduced Income and Employment

The fishery has been heavily over subscribed for years. In response to market demand and rising prices, competition for the clam harvest has escalated. In order to manage the intensive harvesting effort, the commercial openings are short in duration (generally one or two days per tidal cycle) and most areas are closed within a few months or less. The impacts of the shorter fisheries and reduced number of clams available for harvest has been greatest on those who traditionally were able to fish clams commercially on a part-time or seasonal basis in order to supplement their incomes. This is particularly true for many residents of First Nations and other coastal communities. The issue of shorter season and reduced income is largely dealt with by the 1998 clam reform initiative.

2.4.4.1.3 Lost Clam Beds

Pollution from domestic and stormwater outfalls, faulty septic fields, agricultural run-off or discharge from vessels resulted in closures of 73,000 hectares, including shellfish habitat in 1993. This is an increase of approximately 40% since 1972 (Hal Nelson, D.O.E. - pers comm.). Additional foreshore is being closed each year and the incidence of contaminated bivalves is becoming a serious problem in the Strait of Georgia. In the Baynes Sound area, which is heavily tenured, the aquaculture industry and BC MAFF have worked with DFO, CFIA and DOE to develop a management plan to do extra monitoring of water and shellstock quality, in order to meet CSSP requirements. This initiative is called the **Baynes Sound Management Plan.** The Baynes Sound Management Plan allows for the area to be open at times when rainfall levels are low. The industry must do regular sampling of water quality and have a plan in place to contact shellfish growers when the rainfall exceeds acceptable levels and the area closes. This initiative is a special management plan to allow harvesting in an area with identified faecal contamination under certain circumstances i.e. heavy rainfall events.

2.4.4.1.4 Market Considerations

Short, intense commercial fisheries can result in market gluts of fresh product. Staggered openings have been used in an attempt to keep clam supply available year round, but

limited supplies of clams, heavy exploitation, PSP closures, and faecal contamination problems make this difficult. Competition for markets seems to be increasing. There is increased production from clam farms, increased production from the depuration fishery, and there has recently been an impact by Washington State flooding the market with Puget Sound product. With so many possible sources of product, the value of the commercial fishery may be reduced.

2.4.4.1.5 Uncertain Stock Recruitment Relationships

There is concern that intensive commercial harvesting and repeated digging may negatively impact clam survival and growth rates. There is also concern that heavy exploitation of the legal sized clam resource may negatively affect recruitment rates.

2.4.4.1.6 Limited programs

Much of the northern B.C. coast is closed for clam harvesting to recreational, food, social and ceremonial harvest by First Nations and commercial harvest due to lack of funding for required shellfish growing water surveys and PSP monitoring. For this reason, little is known about clam stock composition on the north coast.

Manila clam stocks have been identified as far north as Aristazabel Island (52^0 30' N) (G. Gillespie – pers. Comm.). Littlenecks and butter clams are common, but poor markets limit fishery growth. In order to open the entire North Coast to bivalve harvesting by all user groups, additional funding is required for management and enforcement costs. Industry has indicated a willingness to participate in funding new programs needed to develop new fisheries. For example, commercial geoduck harvesters contribute to the monitoring expenses incurred in shellfish harvesting on the Central Coast. The Aboriginal Fishery Strategy has funded some programs in the Central Coast to allow for PSP monitoring which has permitted the development of a limited commercial fishery by the Heiltsuk First Nation in Bella Bella. In addition, industry assisted with funding for the water quality survey on the north- west coast of Vancouver Island in 1996.

2.4.4.2 Depuration Fishery

Licenced and approved processing plants are permitted to harvest and depurate clams from marginally contaminated areas in the South Coast inside waters. Depuration licences are issued under the Management of Contaminated Fisheries Regulations. Then assigns the processor control and responsibility for harvest on designated beaches. The plants operate year round and provide a consistent supply to the market. A total of five plants have become licensed to operate with a total harvest in 1997 of 440 t. (969,475 lb.)

Landings of depurated clams from aquaculture leases are included in Table 2.4.2., while landings from 'wild' beaches are reported with the commercial clam landings in all of the other tables and figures of this report.

Depuration facilities and therefore harvesting requests for contaminated areas have increased. As more shellfish beach is considered to be contaminated each year, the industry will look at depuration as a way of maintaining production. A management plan for dealing with depuration requests must be developed and applied consistently, as the demand for depuration licences increases.

A draft policy was developed in 1996 in consultation with the depuration industry, which details the strategy for conservative management of the depuration clam fishery. Stock assessment requirements, harvest rates, harvest notification and catch reporting

procedures are detailed in the policy, "The Harvest Of Clams From Contaminated Areas - A Three Year Plan".

While there are benefits to expanding depuration activity in the province, there are difficulties as well. Clams in contaminated areas may be a brood stock reserve providing seed for adjacent wild beaches and their harvest may negatively impact the overall clam population. As a consequence, conservative development of the depuration fishery was adopted in the 1996 policy.

In 1996, the licence holders requested additional harvest sites, and a number of additional beaches were examined for their suitability to clam harvest for depuration. Licence requirements include industry funded stock assessment surveys at each beach. TAC's are set, based on the estimated standing stock present on each beach, in combination with the harvest history to date. Harvest rates for beaches which have not been harvested in recent years (likely to have accumulated clam stocks of several age classes) are set at 25% of the estimated legal sized standing stock, determined by a stock assessment survey. Beaches with a recent harvest history are assigned a 50% harvest rate of legal sized stock.

With the implementation of Clam Reform, First Nations with contaminated beaches fronting Indian Reserves have been given the opportunity to harvest for depuration. In order to do so they must have a joint venture agreement with a registered depuration facility. First Nations diggers are then authorized to harvest under the control and supervision of the depuration plant subject to the conditions identified in the Contaminated Shellfish Harvest License. Biomass surveys must be undertaken and a TAC of 25% of the biomass is authorized. Joint venture opportunities have provided significant economic gains to several First Nations and allowed for controlled harvesting of the product.

The majority of contaminated areas suitable for depuration operations are located adjacent to populated areas. Depuration harvest has caused controversy, as local resident's object to increased harvesting fronting residential neighbourhoods. The 1996 Policy recommends that licenced processors undertake public relations activities in their areas of harvest to inform local residents of their activities.

As of 1997, the Canadian Food Inspection Agency (formerly DFO Inspection Branch) has no mandate under the Fisheries Act. Accordingly, DFO issues Contaminated Harvest Licences. In order for the Department to administer this new workload and properly manage the depuration fishery and related issues, additional personnel resources were required. As a result, a collaborative agreement was struck between DFO and the depurators. The depuration industry has formed the Depurators' Association of B.C. (DABC) and contributes financially to the management of the depuration fishery through a Joint Project Agreement (JPA).

2.4.4.3 First Nations Fisheries

2.4.4.3.1 Food Fishing

First Nations residents of B.C. have the right to harvest clams to meet their food, social and ceremonial needs. The Government of Canada is obligated to respect these requirements while maintaining conservation of the clam resource. Upon requests from First Nation organizations, some beaches have been closed to commercial fishing in order to allow native food fishing year round. However, pollution has forced the closure of many shellfish beaches near native villages, and some native harvesters have to travel greater distances to find clams for food fish.

2.4.4.3.2 Commercial Fishing

The Government of Canada also recognizes the needs of First Nations for commercial clam fishing opportunities. DFO is committed to:

* Negotiating First Nation fisheries agreements. These agreements may provide a specific quantity of fish for food purposes and may also allot a proportion of the catch to be used for economic development opportunities.
* Protecting existing First Nations participation in commercial fisheries and encouraging new native entrants.
* Establishing areas reserved for First Nation subsistence (food) fisheries.

Present management of the commercial clam fishery conflicts with both traditional and new development opportunities for B.C.'s First Nations. Intensive commercial effort has forced the closure of many clam beaches after only a few weeks of annual harvest. These closures displace commercial First Nation diggers who have traditionally harvested part time throughout the year.

Intensified harvesting efforts have also resulted in the utilization of small "pocket" beaches, which were previously deemed to be uneconomical to harvest but which provided opportunities for Native harvesters. In addition, areas available for harvest are being reduced each year due to increasing faecal coliform contamination closures, restriction of fishing on foreshores fronting provincial parks, formation of recreational reserves and expansion of oyster and clam culture tenures.

2.4.4.3.3 First Nation Co-Management

Pilot projects using co-management arrangements are providing commercial opportunities for First Nations on the coast. For example, the continuation of a 1992 pilot project on the Central Coast supplies additional clams to the market and provides much needed employment in the Bella Bella area. On the South Coast, pilot projects have been started in areas fronting or adjacent to I.R.'s at Kuper Island, Kulleet Bay and Squirrel Cove.

First Nations are becoming involved in monitoring the clam resource in co-operation with DFO. The Heltsiuk Band Council has been given exclusive harvesting privileges in the Bella Bella area from 1992 through 1999. The licence authorizes 50 Heiltsuk individuals to harvest 250,000 pounds (113.4 t) each of Manila, littleneck and butter clams. In 1997 a minimal harvest took place, however, landings and values have not been reported in time for this update.

The Haida Nations in the Queen Charlotte Islands (QCI) have worked with DFO and established a co-management program for razor clam fisheries in QCI (Subarea 1-5). Razor clams are delivered to plants in Masset and are primarily sold as bait to be used in the crab fisheries of Washington and Oregon, however, a food market for razor clams is being developed. The preliminary landings were 101 t valued at $174,000 in 1997 as reported by the Haida Fisheries Program. Most of the participants in the fishery are Haida natives but there is a limited licensing of non-native harvesters. The fishery was open from March through August with conservation being addressed through a minimum size limit of 90 mm. for commercial fishers and a bag limit for recreational fishers. A co-operative program of fishery monitoring and stock assessment is in place.

Following stock assessments by the Klahoose band, a conservative annual harvest of 7000 lb. (3.18 t) was set at Squirrel Cove, Cortes Island for 1997/98 at approximately 20% of the estimated legal Manila clams. This allocation was met with a harvest of 7051 lb.

Approximately 4850 lb. were harvested from Kuper Island under the pilot in 1997. Surveys at both Kuper Island and Kulleet Bay have been undertaken in the past but should be updated with current information prior to any further harvesting.

First Nations in the Alert Bay to Sunshine Coast areas and the West Coast of Vancouver Island are becoming more active in participating in the management of local clam fisheries.

2.4.4.4 Recreational Fisheries

Recreational clam digging is enjoyed by local residents and visitors to B.C. The value of this fishery is closely tied to enjoyment of the marine environment and year round opportunities for beach combing. Reserves have been created to preserve recreational opportunities in areas of high demand (Figure 2.4.2). Some coastal residents have expressed frustration with the intensity of the commercial clam fisheries and the perceived disturbance created on their local beaches. Commercial fishery closures have been implemented in many provincial and municipal parks where recreational or Aboriginal harvest for food social or ceremonial purposes is still permitted. Recreational fishing pressure is controlled with a daily bag limit of 75 clams. DFO is receiving requests for additional reserves near coastal communities.

In Canada's Policy for Recreational Fisheries, DFO and the Provinces of Canada announced a commitment to "maintain a high quality and diversity of recreational fishing opportunities". Additional efforts will need to be made to maintain quality recreational clam fishing in British Columbia.

In 1995, the tidal waters sport fishing licence was amended and it is a requirement for all sport fisheries, including those who shellfish harvesters, to be in possession of a licence. There are presently no estimates of effort levels or catch from recreational clam harvesting.

2.4.5 Catch and Effort

The information in this section is data recorded from sales slips. It is the observation of the author that sales slip information is often incorrectly reported, missing entirely, or in some cases incorrectly recorded. Also, note that 1997 data is preliminary.

For the purposes of continuity the information in this section is compiled, as in previous updates, from known sales slip information.

A comparison of landings and values by species and a breakdown of licenses issued by area for the period 1989 to 1997 are provided in Table 2.4.1. Table 2.4.3. summarizes intertidal clam landings by species from 1951 to 1997. Figures 2.4.3 and 2.4.4 show clam landings and values coastwide, 1985 to 1997. Figure 2.4.5 shows cumulative clam landings by Statistical Area for steamer clams (Manila, littleneck and mixed clams), 1985 to 1997. The 1997 data is preliminary and incomplete.

There has been a dramatic shift in landings of the four species of clams (Figure 2.4.3). Historically butter clams dominated the commercial fishery but there was a strong shift to Manila clams in the 1980's due to market demand for steamer clams. Landings of clams peaked in 1988.

In 1997 the combined landings of clams was 1292 metric tonnes compared to 1506 t in 1996. The average price per pound for Manila clams in 1997 was $1.61, up from $1.58 in 1996. The general decline in clam landings since 1989 is largely attributable to reduced fishing times and

a reduction in areas open to commercial fisheries. Active, in-season management has restricted the clam fishery considerably since 1989. The fishery in the south coast was open 161 days in 1997 (Table 2.4.4.). Although this is an increase in fishing time compared to recent years, it is mainly attributable to increased fishing time in Area "G" and does not reflect the main activity in the Manila clam fishing areas. Reduction in clam openings and the loss of clam beaches available for harvest are caused by PSP blooms, increasing faecal coliform contamination problems (a 28% increase in shellfish area closed since 1987), and implementation of conservation closures (Savary Island closed 1989 to 1993 and Area 26 closed in 1992). Landings by Statistical Area are given in Table 2.4.5.

Harvestable wild clam stocks are dependent on annual recruitment, which can vary widely from year to year. Manila clams are highly susceptible to winter kills which can result from freezing and these mortalities can dramatically reduce stocks.

The 1997 landings shown in Table 2.4.1., 2.4.3. and 2.4.5. represent all commercial landings, including depuration harvest and AFS initiatives.

At this time, Tables 2.4.6 and 2.4.7 are more accurate representations of the steamer clam landings in the traditional commercial Manila clam fishery and the depuration fishery for the 1997 year. These tables are generated from hailed catches at the time of each commercial fishery and data reported to South Coast Division on the depuration fishery.

2.4.5.1 Clam Aquaculture

Clam aquaculture is managed and licensed by the provincial Fisheries Ministry (BC Fish.). In order to maintain a tenure, the Ministry requires diligent use of the site. In the case of clam farms, production from a tenure must be equivalent to or exceed 559 kg/ha each year. Non-compliance with this criterion may be cause for cancellation of the tenure.

Clam farm production is increasing (Table 2.4.2. MAFF production statistics). Preliminary production for 1997 is estimated at 800 to 1000 t (Jim Russell, pers. comm.) with a farm gate value of $4.40 to $4.75 million dollars. Of this production, a significant amount was harvested through scientific licences for harvest of undersize clams. There is no available data on the total landings of sublegal Manila clams. As new farmers get into operation, there is potential to substantially increase clam production in B.C.. At this time, 122 clam culture farms have been licenced by the Province. The landings of cultured product also include clams from contaminated leases harvested for depuration.

2.4.6 Stock Assessment Activities

In 1997, stock assessment activities relating to the commercial fishery for intertidal clams included: (1) development of stock estimates and monitoring of biological characteristics of clam stocks at Savary Island; (2) collaborative survey design, sample processing and analyses for the depuration fishery and (3) collaborative survey design, sample processing and analyses for the Aboriginal communal commercial and depuration fisheries.

Activities relating to the depuration fishery in the South Coast included: (1) consultation with depuration processors regarding assessment survey design and protocols, and biological sampling requirements; (2) evaluating stock estimates from thirteen sites surveyed by depuration processors in 1997; (3) development of stock size estimates and summaries of biological characteristics of exploited stocks; and (4) development of an overall stock assessment plan for policy discussions with the depuration industry.

Activities in support of The Aboriginal Fishery Strategy Program (AFS) communal commercial fishery pilots on the South Coast included: (1) consultation with First Nations groups regarding assessment survey design, protocols and biological sampling requirements; and (2) development of stock size estimates and summaries of biological characteristics of exploited stocks.

Research was carried out by Stock Assessment Division staff in 1997 to continue development of scientifically rigorous survey methodologies for intertidal clams, and exploratory surveys of Manila clam stocks in the Queen Chrlotte Islands.

2.4.7 Enforcement Concerns

There is an increasing problem with illegal clam harvesting on beaches closed for conservation or faecal contamination. Poaching of contaminated clams poses a serious health risk and could cause serious marketing problems for the B.C. shellfish industry. The ability of the DFO to control contaminated and closed area fishing is questionable given the present resource limitations.

Curtailing the illegal fishery is simply impossible to achieve with the present enforcement resources and priorities. The tide goes out twice a day every day and for six months of the year low water occurs in the dark. Many beaches on the West Coast of Vancouver Island are in remote areas with little or no enforcement coverage.

The deregulation of the minimum size limit on clams from aquaculture leases may be a major concern because it could open the door to illegal harvesting and laundering of sublegal clams through these aquaculture leases.

2.4.8 Priority Issues

- Continued development of community management boards for 1998/99
- Continued development of First Nations opportunities
- More research to evaluate a stock recruitment relationship for clams as it pertains to the authorised harvest of "undersize" clams on clam tenures and the expansion of the depuration fishery.
- Consider the impact, if any, of the increasing populations of varnish clams (*Nuttallia obscurata*) on B.C. beaches.
- Action on improving sales slip data reporting and recording.

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Table 2.4.1. Annual landings, landed value and commercial licences issued for intertidal clam fisheries 1989 - 1997.

Landed Weight (metric tonnes)		1989	1990	1991	1992	1993	1994	1995*	1996*	1997*
Butter		92	109	42	132	102	174	101	100	145
Manila		2,764	1,456	982	914	1,059	1,376	1,292	1,161	875
Mixed		159	339	137	124	133	87	3	112	112
Native Ln		433	465	201	116	131	94	140	56	60
Razor		117	114	117	55	44	105	140	76	101
TOTAL		3565	2483	1479	1341	1469	1837	1677	1506	1292

Landed Value ($000)		1989	1990	1991	1992	1993	1994	1995*	1996*	1997*
Butter		44	53	34	81	60	103	71	70	103
Manila		6,003	3,761	2,574	2,253	2,761	3,776	4,158	3,349	3,321
Mixed		196	625	238	252	271	198	7	193	192
Native Ln		588	710	327	193	212	147	241	100	117
Razor		124	130	129	82	67	186	247	135	174
TOTAL		6955	5279	3302	2861	3371	4410	4724	3847	3907

Licences Issued		1989	1990	1991	1992	1993	1994	1995*	1996*	1997*
Area A	North Coast	10	69	28	10	11	26		1	2
Area B	Johnstone Strait	224	426	323	263	314	317	491	427	265
Area C	Sunshine Coast	400	184	198	173	199	110	144	145	149
Area D	Upper Strait of Georgia	421	516	598	436	533	568	714	405	503
Area E	Lower Strait of Georgia	374	440	365	587	387	475	441	343	216
Area F	West Coast Vancouver Is.	441	433	331	269	134	267	538	494	346
Area G	Queen Charlotte Strait	76 **		65	76	61	81	120	91	91
TOTAL		1870	2068	1908	1814	1639	1844	2448	1906	1572

*** Note: 1996 and 1997 landings and values are preliminary, north coast landings are not complete for 1996 .**

****this area was previously part of Area B**

Table 2.4.2. Annual clam aquaculture production landings and values, 1985 to 1997, as reported by Ministry of Fisheries.

YEAR	LANDINGS (tonnes)	$000
1985	4	4
1986	7	14
1987	25	43
1988	30	59
1989	31	96
1990	39	140
1991	169	556
1992	310	1000
1993	400	1300
1994	500	1900
1995[1]	885	3885
1996[1]	1000	4750
1997[1]	800 - 1000	4400 - 4750

*** Note: 1997 landings and values**

1. Clam aquacuture landings include licensed harvest of clams for from shellfish leases in contaminated

Table 2.4.3. Annual commercial clam fishery landings and landed values, 1951 - 1997.

YEAR	BUTTER (t)	LITTLE-NECK (t)	MANILA (t)	MIXED (t)	RAZOR (t)	LANDED VALUE ($000)	TOTAL LANDINGS (t)
1951	1,597	237	81	65	61	149	2,041
1952	2,490	224	184	65	57	222	3,020
1953	1,674	140	176	20	70	127	2,081
1954	1,314	66	204	5	123	104	1,712
1955	2,170	36	207	3	99	159	2,515
1956	1,454	14	99	**	108	102	1,676
1957	1,606	10	29	11	84	102	1,739
1958	987	18	15	6	75	65	1,101
1959	1,094	22	25	13	90	75	1,244
1960	1,800	41	6	23	101	133	1,971
1961	857	46	48	34	104	76	1,089
1962	1,533	92	69	43	77	139	1,813
1963	1,144	59	59	**	67	103	1,329
1964	570	69	26	1	48	59	714
1965	704	82	97	0	68	106	951
1966	831	105	149	1	35	125	1,121
1967	975	139	92	**	46	163	1,252
1968	399	91	164	15	12	98	681
1969	378	107	81	7	8	85	581
1970	792	144	79	15	18	184	1,049
1971	568	361	153	11	62	235	1,156
1972	645	631	265	1	17	382	1,559
1973	298	207	134	0	76	196	715
1974	531	328	182	0	69	383	1,110
1975	746	236	158	6	27	333	1,173
1976	655	173	199	70	82	340	1,179
1977	649	209	394	59	78	545	1,389
1978	383	159	753	245	47	834	1,587
1979	613	273	251	374	101	916	1,612
1980	760	358	288	151	75	1,001	1,632
1981	119	179	318	161	30	737	806
1982	102	242	598	155	68	1,135	1,165
1983	77	324	1,048	279	31	1,723	1,759
1984	130	294	1,677	410	100	2,757	2,610
1985	251	191	1,913	477	90	3,288	2,922
1986	158	284	1,893	371	142	3,801	2,848
1987	68	373	3,607	87	142	6,775	4,277
1988	134	290	3,909	27	155	7,770	4,515
1989	92	433	2,764	159	117	6,955	3,565
1990	109	465	1,456	339	114	5,279	2,483
1991	42	201	982	137	117	3,302	1,479
1992	132	116	914	124	55	2,861	1,341
1993	102	131	1,059	133	44	3,371	1,469
1994	174	94	1,376	87	105	4,410	1,837
1995*	101	140	1,292	3	140	4,724	1,677
1996*	100	56	1,161	112	76	3,847	1,506
1997*	145	60	875	112	101	3,907	1,292
Totals	32,254	8,549	31,510	4,415	3,611	74,182	80,340

** Less than 500 kg.

* **Note: 1996 and 1997 landings and values preliminary.**

Note: Years 1957-69 from Quayle and Bourne, (1972)

Years 1970-97 from sales slip records. 1993 to 1997 include depuration from non-leased beaches and aboriginal licenced harvest

Table 2.4.4. Fishing opportunities for commercial intertidal clam fishery 1991 to 1997

LICENCE AREA	DESCRIPTION	DAYS OPENED						
		1991	1992	1993	1994	1995	1996	1997
A	North Coast (Subarea 1-5) Razor clam fishery	all year	all year	all year	all year	all year	all year	all year
B	Johnstone Strait Area 12 (1991 only)	38						
	Area 13	28	18	8	8	6	4	6
C	**SUNSHINE COAST** Savary Island closed*	48*	38*	16*	39	24	25	25
D	**UPPER STRAIT OF GEORGIA** Lower Portion - Qualicum/Parksville and Lasqueti Island	7	9**	4**	3	2		2
	Upper Portion - Baynes Sound	5	6**	3**	3	1	4	
E	**LOWER STRAIT OF GEORGIA**	19	9	7	7	5	5	4
F	West Coast Vancouver Island only limited areas open on given days due to PSP; Area 26 closed	20	20	24	24	24	16	16
G	Queen Charlotte Strait (Area 12)		47	68	98	111	65	108
TOTAL (Areas B-G)		**117**	**94**	**129**	**182**	**173**	**119**	**161**

** Area D - total - 10 days in 1992, 6 days in 1993

Others	Heltsiuk Communal Licence - Area 7		42					

[1] 50 diggers maximum under one Communal Licence

Table 2.4.5. Manila, littleneck and mixed clam landings (tonnes), from the south coast of British Columbia (areas 11 to 29) by species and by year, 1985 to 1997 (preliminary) from sales slip data.

		Pacific Fishery Management Area																	
Year	Species	11	12	13	14	15	16	17	18	19	28	29	20	23	24	25	26	27	Total
1985	manila		5.8	272.1	297.4	241.4	108.2	372.3	25.1	4.7			37.8	29.6	247.6	143.9	98.5	28.3	1912.7
	littleneck		31.7	27.1	53.5	9.0	11.7	25.8	2.5	1.0			16.9	1.4	9.5	1.5			191.6
	mixed		8.8	176.3	36.9	77.3	43.0	40.5	9.5	4.1			22.3	9.4	16.2	11.8	21.1		477.2
	TOTAL		46.3	475.5	387.8	327.7	162.9	438.6	37.1	9.8			77.0	40.4	273.3	157.2	119.6	28.3	2581.5
1986	manila		4.3	291.4	375.4	362.7	79.9	367.1	25.6	1.3		1.0	6.2	2.5	146.5	197.5	22.5	9.0	1892.9
	littleneck		36.2	32.5	104.4	14.2	8.1	58.2	2.7	0.6		0.1	6.3		4.2	11.7	3.0	2.0	284.2
	mixed		16.4	72.4	19.9	93.2	23.7	91.2	2.1	2.7		1.4	20.6	0.2	7.1	17.3	1.0	1.5	370.7
	TOTAL		56.9	396.3	499.7	470.1	111.7	516.5	30.4	4.6		2.5	33.1	2.7	157.8	226.5	26.5	12.5	2547.8
1987	manila		16.2	513.7	898.7	617.5	109.7	676.9	26.6	6.6	0.8	0.1	12.3	114.6	210.4	255.8	122.7	23.6	3606.2
	littleneck		68.9	80.2	66.6	18.0	2.3	66.6	10.9	3.7			30.7	0.7	7.8	14.2	1.9	0.6	373.1
	mixed		0.5	20.1	5.8	23.9	2.4	16.9	1.4	0.3			4.6		0.6	8.3	1.8		86.6
	TOTAL		85.6	614.0	971.1	659.4	114.4	760.4	38.9	10.6	0.8	0.1	47.6	115.3	218.8	278.3	126.4	24.2	4065.9
1988	manila	0.1	14.8	593.1	749.2	586.9	157.1	848.8	107.8	11.6	0.2	3.2	0.4	92.0	304.8	254.8	182.5	1.1	3908.4
	littleneck		55.2	71.1	24.4	21.8	2.5	65.5	7.6	5.6			15.2	0.2	14.6	2.3	4.1		290.1
	mixed			3.5	6.0	1.2	0.1	2.8	0.4	1.9			9.2		0.5	1.3	0.3		27.2
	TOTAL	0.1	70.0	667.7	779.6	609.9	159.7	917.1	115.8	19.1	0.2	3.2	24.8	92.2	319.9	258.4	186.9	1.1	4225.7
1989	manila		5.9	295.5	441.4	663.8	241.0	370.6	37.4	56.8			0.2	182.0	128.8	224.3	94.7	21.8	2764.0
	littleneck	0.1	87.1	161.3	23.4	59.3	11.3	38.0	5.8	4.3				1.6	21.3	9.8	0.7	9.5	433.5
	mixed			1.0	1.8	29.6	6.5	10.8	4.1	10.0			94.6	0.1	0.4	0.3			159.2
	TOTAL	0.1	93.0	457.8	466.6	752.7	258.8	419.4	47.3	71.1			94.8	183.7	150.5	234.4	95.4	31.1	3356.7
1990	manila		1.9	434.7	313.8	64.3	110.6	212.2	13.0	11.0		0.6		104.3	95.9	89.0	0.6	4.5	1456.4
	littleneck		57.5	291.7	85.6	2.4	7.4	6.3	1.2				0.1	1.0	5.2	1.6		2.2	465.2
	mixed		2.0	97.2	45.3	0.1	7.0	20.9		29.2			82.3	0.7	4.3	49.7			338.7
	TOTAL		61.4	823.6	444.7	66.8	125.0	239.4	14.2	40.2		0.6	82.4	106.0	105.4	140.3	0.6	6.7	2260.3
1991	manila		6.4	157.0	252.6	108.9	93.1	189.7	26.3	12.9			0.1	12.4	39.9	82.9			982.2
	littleneck		49.2	53.3	53.7	7.1	10.0	10.9	12.5					0.1	2.9	0.7			200.4
	mixed		1.0	14.1	5.9	1.6	7.9	28.7	3.0	19.7			54.8		0.1	0.4			137.2
	TOTAL		56.6	224.4	312.2	117.6	111.0	229.3	41.8	32.6			54.9	12.5	42.9	84.0			1319.8
1992	manila		4.2	111.7	258.0	83.9	78.7	191.0	2.0					79.7	30.2	68.2			907.6
	littleneck		63.0	8.4	27.8	2.1	2.5	11.3						0.4	0.4	0.4			116.3
	mixed		0.5	0.6	1.1	0.1		44.0		37.0			40.0		0.2	0.4			123.9
	TOTAL		67.7	120.7	286.9	86.1	81.2	246.3	2.0	37.0			40.0	80.1	30.8	69.0			1147.8
1993	manila		1.4	107.6	312.0	43.3	98.9	240.5	16.0	2.5				3.1	56.3	84.7			966.2
	littleneck		62.2	9.7	53.6	0.4	1.3	2.9	0.2					0.6	0.5	0.1			130.8
	mixed		0.6	0.6	2.1	0.1	0.7	68.0	*	47.0			14.0						133.1
	TOTAL		64.3	117.8	367.7	43.7	100.9	311.4	16.2	49.5			14.0	3.1	56.8	84.8			1230.2
1994	manila		0.3	168.1	322.3	171.9	87.5	286.0	9.0					99.8	85.7	63.8			1294.4
	littleneck		50.1	4.4	35.6	0.6	0.5	2.1						0.1	1.1				94.4
	mixed			0.0	0.5	0.2	0.0	21.9		37.3			27.4		0.2				87.5
	TOTAL		50.4	172.5	358.4	172.7	88.0	310.0	9.0	37.3			27.4	99.8	87.0	63.8			1476.3
1995*	manila			129.0	220.4	175.2	57.4	237.0	0.6	7.6	0.4		12.5	64.3	100.1	84.0	102.7		1191.0
	littleneck		40.8	3.3	15.5	0.8	0.0	42.1		15.1			17.7	0.7	1.9	0.6	1.5		140.0
	mixed			0.2	0.0			2.4							0.8				3.4
	TOTAL		40.8	132.4	235.9	176.0	57.5	281.5	0.6	22.7	0.4		30.2	64.9	102.7	84.6	104.2		1334.4
1996*	manila			93.3	122.6	206.7	84.6	411.9	6.8			1.1	0.1	34.5	66.3	47.0	86.2		1161.1
	littleneck		45.9	2.7	0.9	0.8	0.4	1.3						0.4	2.9	0.0	0.1		55.3
	mixed			0.3			0.3	39.7		18.4			53.4		0.1	0.3			112.5
	TOTAL		45.9	96.4	123.5	207.4	85.3	452.9	6.8	18.4		1.1	53.5	34.9	69.3	47.3	86.3		1328.9
1997*	manila			48.8	170.4	258.2	26.3	165.9	4.8			0.2		22.6	41.8	58.5	77.3		874.7
	littleneck		50.3	1.2	4.3	1.6		1.1							0.9		0.2		59.6
	mixed			0.2	0.4			57.8		8.4			44.4		0.5				111.6
	TOTAL		50.3	50.1	175.1	259.8	26.3	224.8	4.8	8.4		0.2	44.4	22.6	43.2	58.5	77.5		1046.9
Total		0.2	789.1	4349.2	5409.2	3949.8	1482.7	5347.6	364.8	361.3	1.4	7.7	624.0	858.3	1661.5	1787.1	823.4	103.9	27921.3

* Note: 1996 AND 1997 landings are preliminary. Depuration fishery landings from wild beaches are included. Aquaculture landings are not.

Table 2.4.6. Hailed landings: Manila, littleneck and mixed clams combined 1990 to 1997

LANDINGS IN POUNDS									
AREA	1990	1991	1992	1993	1994	1995	1996	1997	Average
A									-
B		381,000	323,000	287,000	399,934	339,659	307,885	227,892	323,767
C		200,000	200,775	247,000	432,026	498,579	549,832	707,334	405,078
D	1,000,000	491,632	694,237	500,000	598,668	351,447	356,937	155,980	518,613
E				375,000	597,918	334,321	350,056	192,189	369,897
F				476,218	495,792	753,998	637,248	571,565	586,964
G (LN)					110,532	92,314	106,116		102,987
G (BC)					106,611	106,646	90,410		101,222
TOTAL	NOT INCL BUTTERS			1,885,218	2,634,870	2,370,318	2,308,074	1,854,960	2,307,306
LANDINGS IN TONNES									
AREA	1990	1991	1992	1993	1994	1995	1996	1997	Average
A									-
B	-	173	147	130	181	154	140	103	147
C	-	91	91	112	196	226	249	321	138
D	454	223	315	227	272	159	162	71	226
E	-	-	-	170	271	152	159	87	168
F	-	-	-	216	225	342	289	259	266
G (LN)	-	-	-	-	50	42	48	-	47
G (BC)	-	-	-	-	48	48	41	-	46
TOTAL	NOT INCL BUTTERS		552	855	1,195	1,075	1,047	841	992

Table 2.4.7. Depurated Clam Landings 1990 to 1997: Total landings for Beaches Allocated to the Depuration Fishery

LANDINGS IN POUNDS								
Year	1990	1991	1992	1993	1994	1995	1996	1997
Manila	57,099	-	141,447	325,002	216,844	424,275	878,857	900,652
Littleneck	199,913	241,432	266,051	284,856	189,331	159,966	32,297	68,823
Total (lbs)	257,012	241,432	407,498	609,858	406,176	584,241	911,155	969,475
LANDINGS IN TONNES								
Year	1990	1991	1992	1993	1994	1995	1996	1997
Manila	26	-	64	147	98	192	399	409
Littleneck	91	110	121	129	86	73	15	31
Total (t)	117	110	185	277	184	265	413	440
Note: 1996 includes 190.47t of clams depurated from oyster tenure included in wild fishery landings.								

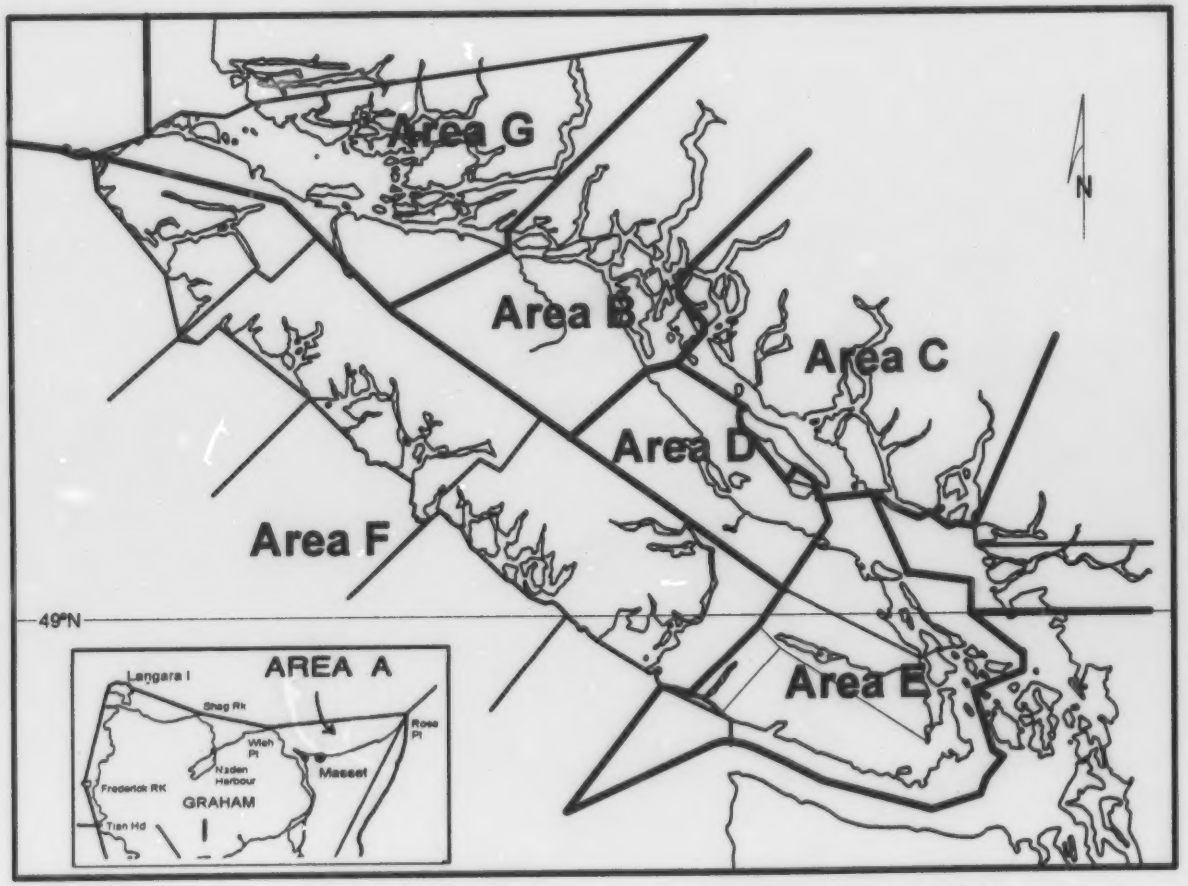

Figure 2.4.1. Commercial Clam Harvest Licence Areas. (Implemented in 1989, Area G in 1992)

A: North Coast
B: Johnstone Strait
C: Sunshine Coast
D: Upper Strait of Georgia
E: Lower Strait of Georgia
F: West Coast of Vancouver Island
G: Queen Charlotte Sound

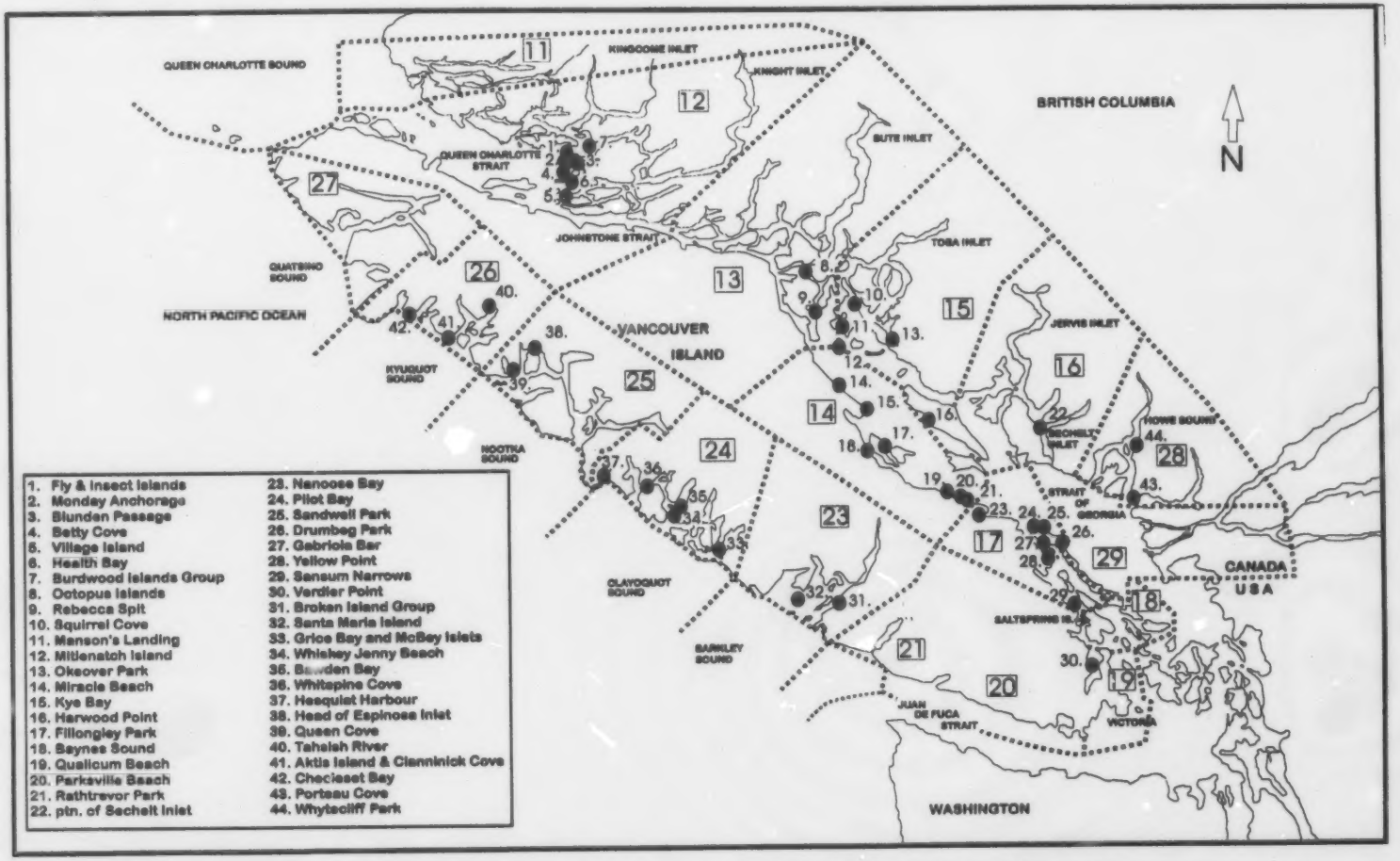

Figure 2.4.2. Commercial closures in 1997 for park, recreational or Aboriginal clam Harvest.

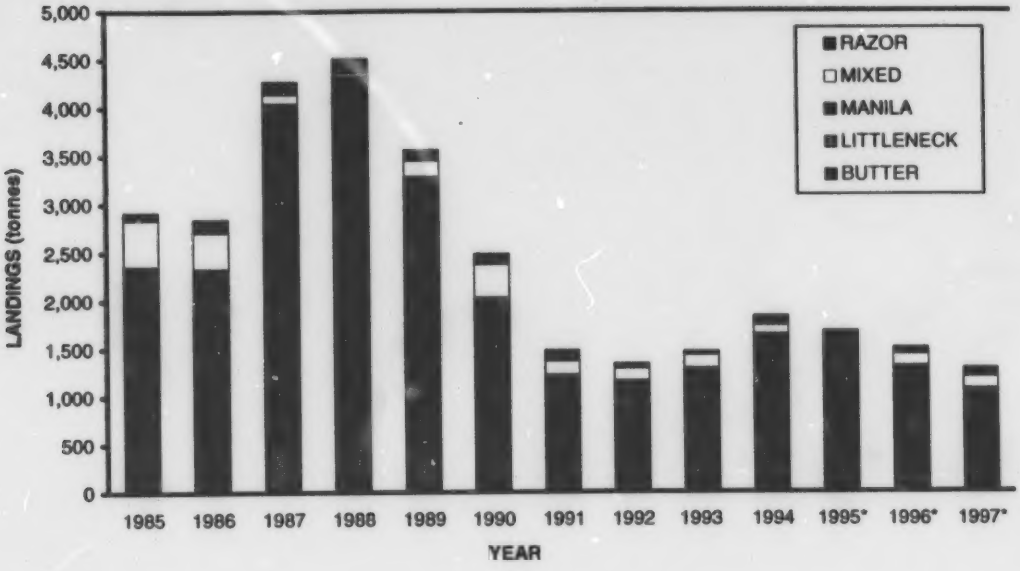

Figure 2.4.3 Landings of commercial clam fishery 1985 to 1997

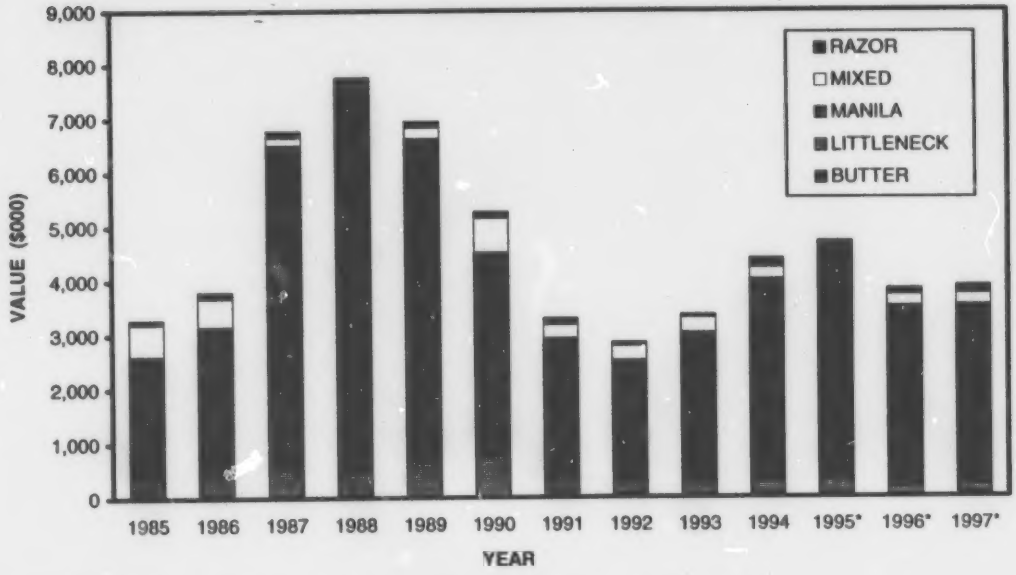

Figure 2.4.4 Landed values of commercial clam fishery 1985 to 1997

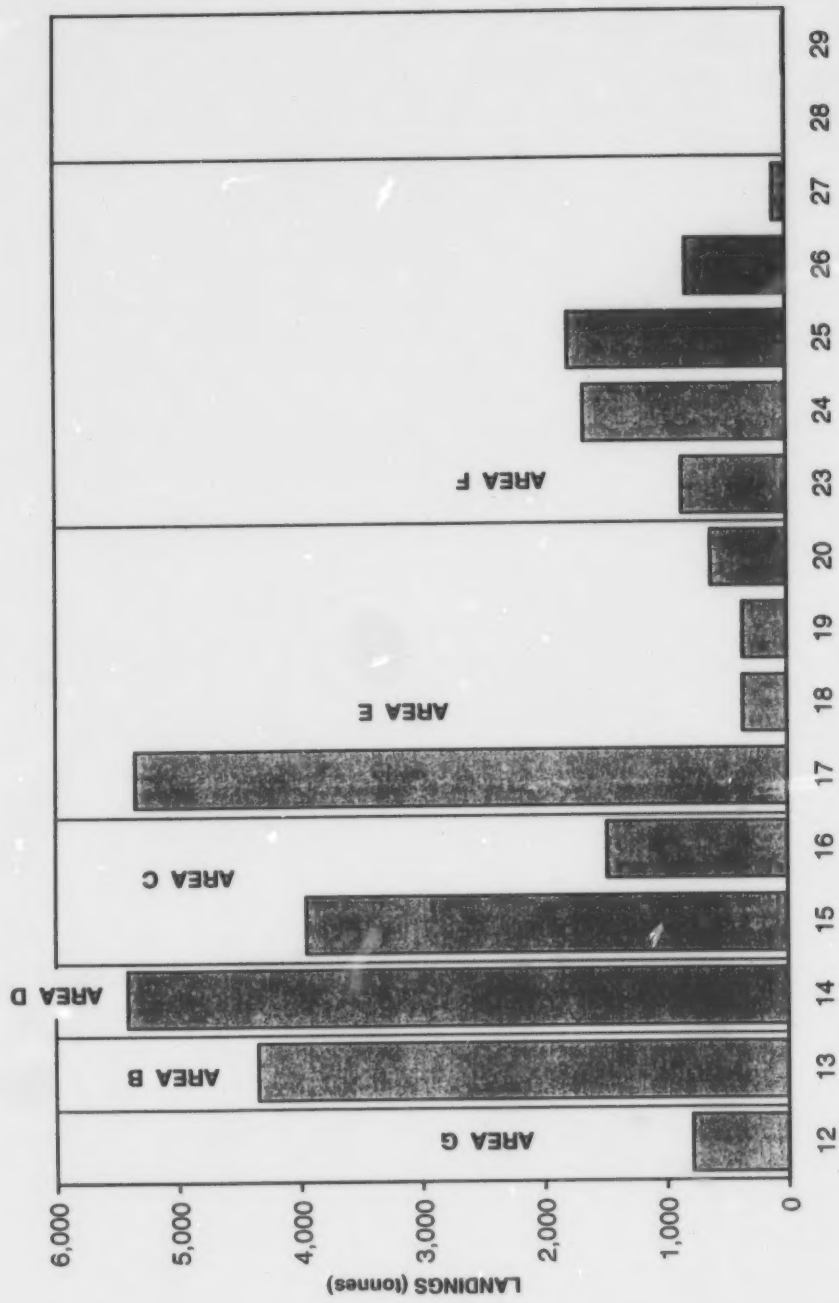

Figure 2.4.5. Cumulative total littleneck, Manila and mixed clam landings 1985 to 1997

2.5. Opal Squid Fishery - J. Rogers, K. Kattilakoski, J. Morrison and G. Gillespie

2.5.1 Introduction

Opal squid (*Loligo opalescens*) are largely taken by seine, but hook and line and side catcher or frame nets are also used to a lesser extent. A category Z-E squid license is required to participate in this fishery. Squid landed in British Columbia are mainly used as bait in the crab, sablefish and halibut fisheries. There is interest in marketing squid as a food product in B.C., however the large California squid fishery produces a low priced food product making it difficult for B.C. squid to compete in this market.

Preliminary reported landings of squid in 1997 were 6 tonnes; significantly less than the previous 10 year average of 86 t (Table 2.5.1.). Most of the landings have been reported from the North Coast in Areas 7 and 8, though some landings were reported from the South Coast in Areas 12 and 23. The total landed value of this fishery in 1997 was $8,140. The average ex-vessel price was $1.44·kg^{-1}, an increase from the preceding year's $1.21·kg^{-1}. The number of licences issued decreased from 107 in 1996 to 55 in 1997. The number of licenced vessels reporting landings decreased from 15 to 5.

2.5.2 Fishery Management Actions

The squid management plan is reviewed annually and prepared in November. The fishery requires an annual licence to harvest squid by seine, trawl, frame net or hook and line. This fishery is closed by regulation January 1 to December 31 and areas are opened by Variation Order upon request by fishers. Permanent area closures described in the 1997 management plan did not change in any substantive manner from previous years. Submission of logbooks and fish slips were required as a condition of licence.

2.5.3 Catch and Effort

In 1997, South Coast areas recorded landings of 0.3 t while North Coast areas recorded landings of 5.7 t., 4% and 96% of the coast wide total respectively. The majority of landings were recorded from April through May (Table 2.5.2.). In 1997, less than 500 kg were landed from Area 23, compared to 44 tonnes in the previous year (Table 2.5.3.). Area 23 has traditionally accounted for 87% to 100% of the annual landings from 1987 to 1994, the period for which these summary results are available. However, in 1995 and 1996 this dropped to 39% and 63% respectively. In 1997, less than 500 kg have been reported for Area 23/123.

CPUE estimated from harvest logs for 1997 was 0.14 t·vessel^{-1}·day^{-1} compared to 0.4 t·vessel^{-1}·day^{-1} for 1996 and 0.6 t·vessel^{-1}·day^{-1} for 1995. 7 vessels reported landings of squid in 1997, much lower than the 15 vessels who reported landings in 1996.

2.5.4 Stock Assessment Activities

The Shellfish Data Unit collected and processed harvest log information the squid fishery in 1997. No new assessment activities or research were undertaken for squid in 1997.

2.5.5 Enforcement Concerns

There was no directed enforcement action taken in this fishery and no enforcement concerns have been identified.

2.5.6 Industry and Stakeholders

There is no sectoral committee established for this fishery. No specific concerns have been identified to DFO by fishers, buyers, processors, First Nations or other stakeholders.

2.5.7 Priority Issues

- Landings are likely under-reported on logbooks as fishers have little incentive to report catch. Much of the catch is landed for personal use as bait.
- Squid licences are unlimited, that is, as many are issued as are requested annually. There is no information on the size of squid stocks on the coast, and accordingly no estimate of what may constitute a sustainable fishery.
- There is no information about bycatch from this fishery.
- Seiners can impact and damage the bottom when fishing for squid, particularly if they are targeting on spawning aggregations. This may also remove or damage egg masses deposited by the spawning stock.

References

Rice, J.C., R.D. Humphreys, L. Richards, R. Kadowaki, D. Welch, M. Stocker, B. Turris, G.A. McFarlane, F. Dickson and D. Ware [eds.]. 1995. Pacific Stock Assessment Review Committee (PSARC) annual report for 1994. Can. Man. Rep. Fish. Aquat. Sci. 2318. 404 p.

Table 2.5.1. Squid landings, value and effort, as determined from sales slips and harvest log data, 1984-1997.

Year	No. licenses issued	No. licenses fished	Fishing days	Total Landings (t)	Landed Value ($·10³)	Landed Value ($·Kg⁻¹)	CPUE (t·vessel⁻¹·day⁻¹) sales slips	CPUE (t·vessel⁻¹·day⁻¹) harvest logs
1984		26	N/A[1]	69	25	0.36	N/A	N/A
1985		24	274	111	184	1.66	0.4	0.9
1986		18	288	89	127	1.43	0.3	0.7
1987		8	123	86	132	1.53	0.7	1.1
1988		8	98	88	113	1.28	0.9	N/A
1989		7	56	70	94	1.34	1.3	0.8
1990		9	115	72	81	1.13	0.6	0.8
1991		9	65	116	148	1.28	1.8	1.6
1992	47	5	77	93	135	1.46	1.2	1.2
1993	47	7	32	13	17	1.3	0.4	0.3
1994	46	7	155	175	199	1.14	1.1	1.2
1995	81	9	168	74	94	1.26	0.4	0.6
1996	107	15	372	71	87	1.21	0.2	0.4
1997[2]	55	7	41	6	8	1.44	0.13	0.14

[1] Days fished not available.
[2] Preliminary data from sales slips, 1997.

Table 2.5.2. Summary of squid landings (t), all gear, by month in 1997, as reported on sales slips and harvest logs.

	TOTALS					NORTH COAST MANAGEMENT AREAS										
	Total Coast	North Coast	South Coast	ECVI	WCVI											
	(t)	(t)	(t)	(t)	(t)	1	2E	2W	3	4	5	6	7	8	9	10
Jan.																
Feb.																
Mar.																
Apr.	1.2	1.2					0						1.1	0.1	0	
May	4.5	4.5	0.0		0.0								1.3	3.2		
June																
July																
Aug.							0		0							
Sep.	0.3		0.3	0.3												
Oct.																
Nov.																
Dec.																
Totals	5.9	5.7	0.3	0.3	0.0								2.4	3.3		

	SOUTH COAST MANAGEMENT AREAS																	
	East Coast Vancouver Island											West Coast Vancouver Island						
	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27
Jan.																		
Feb.																		
Mar.																		
Apr.																		
May	0							0						0.0				
June														0				
July																		
Aug.																		
Sep.		0.3																
Oct.																		
Nov.																		
Dec.																		
Totals		0.3												0.0				

0 = catch reported less than 500 kg.

Table 2.5.3. Summary of squid landings (t), all gear, by year and area, as reported on sales slips.

	TOTALS					NORTH COAST MANAGEMENT AREAS										
	Total Coast	North Coast	South Coast	ECVI	WCVI											
	(t)	(t)	(t)	(t)	(t)	1	2E	2W	3	4	5	6	7	8	9	10
1987	85.9	0.3	85.6	0.3	85.3	0.3							<			
1988	86.4	3.0	85.4		85.4	0.2		0.1						0.8	1.9	
1989	69.8	8.8	61.0	0.5	60.5								8.8			
1990	71.3	0.6	70.7	0.7	70.0			0.6								
1991	115.9		115.9	1.2	114.7											
1992	92.6		92.6	0.2	92.4											
1993	13.3		13.3	2.6	10.7											
1994	174.3	7.1	167.2	0.7	166.5								7.1			
1995	69.8	41.5	28.3		28.3			4.0					7.5	20.3	9.7	
1996	71.3	20.8	50.6	5.7	44.8				0.1				4.0	3.0	13.8	
1997	5.9	5.7	0.3	0.3	0.0								2.4	3.3		

	SOUTH COAST MANAGEMENT AREAS																	
	East Coast Vancouver Island											West Coast Vancouver Island						
	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27
1987		0.2		<				<	<	0.1				67.2	18.1			
1988														85.4				
1989			0.5						<					60.5				
1990		0.2		<				0.3	<	0.1	0.1			67.7	2.3			
1991	0.4	0.3		0.5			<							99.6	15.1			
1992		0.2												92.4				
1993				0.1			2.5							10.7				
1994							0.7							166.5				
1995														27.7	0.6			
1996							0.0		5.7					44.8	0.0			
1997		0.3												0.0				

< = catch reported less than 50 kg.

2.6. Octopus Dive and Trap Fisheries - G. Parker

2.6.1 Introduction

Historically, octopus (Octopus dofleini) landed in British Columbia has been primarily utilized as bait in other fisheries such as the halibut fishery. Between 1988 and 1990 the coast-wide catch of octopus from all gear types was about 200 t annually but since declined to 81 t in 1995 (Table 2.6.1). This was an effect of the introduction of the IVQ (individual vessel quota) in the halibut fishery. Halibut fishers now make greater use of bycatch such as pink salmon and other lower priced bait rather than octopus (B. Ackerman, DFO Groundfish Management Unit. pers. comm.). Recently there have been attempts to organize the fishery in order to fill European and Asian market demands for food quality octopus. The majority of octopus are landed by divers and lesser amounts are taken incidentally in the prawn and crab trap fisheries and the groundfish and shrimp trawl fisheries. Current overseas markets are demanding larger product, 10+ lbs. As a result, buyers have put most effort into trying to organize the dive fishers in the south, who generally catch larger octopus. Octopus caught in traps such as prawn traps are usually smaller because of the small opening in the traps. In 1996 there was also an attempt by the Octopus Development Institute to start a directed trap fishery in the Prince Rupert area.

Prior to 1992 all octopus harvesting was conducted under a single category Z-J licence. In 1992, upon the advice of industry, separate licences were issued for octopus by diving (Z-G) and octopus by trap (Z-P). Harvest logs of fishing activity are required as a condition of both licenses.

The average whole landed value for octopus by all gear types in 1997 was $3.70/kg, a slight increase from $3.59/kg in 1996. (Table 2.6.1). This varied by gear type where in 1996 the whole landed value was $3.69/kg for dive caught octopus, $2.98/kg for trawl caught octopus, and $3.47/kg for trap caught octopus. Reported landings from sales slips indicate that the fishery was worth about approximately $750,880 in 1997, an increase of $269,000 from the 1996 value of $482,000.

2.6.2 Management Objectives

Specifically for the Octopus fishery:

1. Establish closed areas within all current commercial fishing areas to ensure protection of local populations
2. Restrict expansion of fishing activity until the status and condition of stocks are appraised.
3. Develop research and stock assessment programs to ensure sustainability of octopus stocks.

2.6.3 Fishery Management Actions

Management of this fishery to date has been restricted to area closures, collection of harvest logbook data, and limiting tools and equipment used for collection. This fishery is undertaken under licence in the octopus dive and trap fishery, and as incidental catch in trawl fisheries (shrimp and groundfish). As a result, outside of the dive fishery that is open all year in some areas, fishing opportunity varies in conjunction with other fishery openings. In 1997 the shrimp trawl fishery was open throughout the year, but the octopus by trap fishery opened with the prawn fishery on April 15, and closed in season as the prawn trap fishery closures were put in place. A total closure for octopus by trap was implemented July 29/97.

In 1995 prawn fishers were provided with the authority to fish octopus under the terms and conditions of the W prawn by trap licence, and were not required to hold a separate octopus by trap Z-P licence. This created the apparent discrepancy in Table 2.6.1 where only 80 trap licences were issued in 1995, but 99 licences reported landings. This excess of licences reporting landings is attributable to reports made by prawn licence holders.

Park, research areas, and ecological reserve closures are described in the 1996 Octopus by Dive and Octopus by Trap Management Plans. Daily harvest logs and sales slips are required as a condition of both licences. No in-season monitoring of the octopus fishery occurs.

2.6.4 Catch and Effort

2.6.4.1 Landings

Landings of octopus increased substantially between 1985 and 1989 from 28 t to 209 t but declined to 81 t in 1995 (table 2.6.1). Prior to 1991, 70 to 80% of the annual landings were from the dive fishery and about 10% were reported as incidental catch from trap fisheries. Declining annual catch since 1991 has largely been the result of declining catches in the dive fishery, when landings fell from a high of 154 t in 1990 to 47 t in 1995. Trap caught octopus landings increased from about 20 t in 1990 to a peak of 72 t in 1997.

The majority of octopus landings occur in south coast areas. In 1997 most of the catch was reported from areas 12, 17, 18, 19, and 24 (Table 2.6.2.). Annual landings of octopus in 1997 were 208 t, of which 111 t were from the dive fishery, 72 t from the trap fisheries, and the remainder from the trawl and miscellaneous fisheries. 1997 saw an increase in catch from the 1996 levels of 153 t total landings. This increase was mostly due to increased effort and landings in the dive fishery, which saw landings, increase from 76 t in 1996, to 111 t in 1997.

2.6.4.2 Effort

Effort (vessel days from sales slips) increased between 1986 and 1989 paralleling landings, and remained relatively constant until 1991 at 180 active participants and about 4,600 to 4,900 fishing days, (Table 2.6.1). Landings declined in 1991 and 1992 followed by a reduction in active participants commencing in 1992. 1997 saw the largest number of licences issued in the octopus fishery, with 77 Z-G dive licences issued, and 235 Z-P trap licences issued.

Most effort is reported by prawn and crab trap fishers, with 4143 days reported on sales slips in 1997, a slight decline from the 1996 value of 5617. Investigations into the state of the octopus trap and trawl records indicate that true effort can not accurately be calculated. In 1997, octopus by dive records show 726 days of fishing activity compared to 436 days in 1996 (preliminary data) (Table 2.6.1.). The effort reported by trawl fishers declined from 1147 days in 1993 to 37 days in 1994 but has increased to 344 days in 1996 (preliminary data). Accurate values for the 1997 trawl fisheries are not yet available.

2.6.4.3 CPUE

Harvest information for catch and effort calculations from the dive fishery were obtained from commercial harvest logs. Catch per diver hour remained low during the initial years of the fishery but increased during the late 1980's and peaked in 1987 at 84 kg/hr. In 1990 CPUE began to decline dropping in three consecutive years to a low of 51.8 kg/hr. CPUE recovered to 90.9 kg/hr in 1994 but then again underwent consecutive drops in

1995-96. Preliminary catch rates for 1997 show a slight recovery in catch rate, rising to 62.1 kg/hr from 59.1 kg/hr in 1996.

Although fishing effort occurs primarily during fall and winter, monthly CPUE rates do not vary considerably by season. Monthly averages calculated over the last 14 years show only a small decrease during late spring and early summer.

Average annual maximum harvest depth per dive increased during the initial years of the fishery from 13.4 m (44 ft.) in 1983, to 18.6 m (61 ft.) in 1986. Since 1986 maximum depth has remained relatively stable with the exception of years following peak harvest, 1988 and 1994. During these periods harvesters dove to an average maximum depth of 20.7 m (68 ft.) and 20.4 m (67 ft.) respectively.

Catch and effort calculation can not accurately be completed for the trap and trawl fisheries. Current logs provide only an indication of catch.

2.6.5 Stock Assessment Activities

The Shellfish Data Unit collected and processed harvest log information for octopus dive and trap fisheries in 1997.

2.6.6 Enforcement Concerns

Although landings have been reported from the hook and line fisheries, this method of harvesting is illegal. There is no directed enforcement attention to this fishery.

2.6.7 Industry and Stakeholders

In 1997, industry divers created the Pacific Octopus Harvester's Association. The association represents many of the active octopus dive fishers.

2.6.8 Priority Issues

- Fisheries and Oceans has become increasingly concerned over the magnitude and speed at which plans are being made to expand the octopus fishery. At present there is little information available on these stocks and as such they will be treated in a very conservative manner.
- The DFO will be trying to work with individuals in the octopus fishery to consult on areas within south coast commercial fishing grounds that will be closed to commercial fishing. These areas will act as refugia for a portion of the population and will help protect against over exploitation of individual stocks.
- Concerns with the use of chemicals (bleach solutions) to harvest octopus by diving were identified in 1993. This is illegal under the Fisheries Act.

References

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Rice, J.C., R.D. Humphreys, L. Richards, R. Kadowaki, D. Welch, M. Stocker, B. Turris, G.A. McFarlane, F. Dickson and D. Ware [eds.]. 1995. Pacific Stock Assessment Review Committee (PSARC) annual report for 1994. Can. Man. Rep. Fish. Aquat. Sci. 2318. 404 p.

Table 2.6.1. Octopus landings, value and effort, as determined from sales slips and harvest log data, 1985-1997.

Year		No. licences issued	No. licences fished	Fishing days	Total Landings (t)	Landed Value ($\$\cdot10^3$)	Whole Landed Value ($\$\cdot kg^{-1}$)	CPUE ($t\cdot vessel\ day^{-1}$)
1985			131	1898	28	82	2.93	
1986			131	1850	50	136	2.72	
1987			149	3439	105	381	3.63	
1988			150	4302	194	651	3.36	
1989			179	4608	190	707	3.72	
1990			181	4586	210	657	3.13	
1991		306	179	4897	91	415	4.56	
1992	Trap & trawl[1]	199	126	4017	48	110	2.44	
	Dive	73	36	897	44	233	3.33	0.05
1993	Trap & trawl[1]	175	140	3581	79	191	2.42	
	Dive	71	21	531	67	242	3.57	0.13
1994	Trap & trawl[1]	161	68	2884	44	64	1.46	
	Dive	62	28	791	48	163	3.4	0.06
1995	Trap & trawl[1]	80	99	3408	35	73	2.09	
	Dive	57	26	436	47	193	4.11	0.11
1996	Trap & trawl[1]	233	155	5617	77	224	3.47	
	Dive	64	50	436	76	258	3.69	0.17
1997	Trap & trawl[1]	235	97	4143	97	350	3.61	
	Dive	77	27	726	111.1	401	3.61	0.15

1 Trap and trawl includes shrimp trawl, mid water trawl, other trawl, shrimp trap, crab trap and other trap.
2 Includes minor catch by hook and line.
3 Preliminary data from 1997 sales slips.
4 Shrimp by trap fishers were not required to hold a licence to land and report octopus in 1995.
note -- 1997 price per kg is averaged for all gears

Table 2.6.2. Summary of octopus landings in tonnes, all gear types, by year and area, as reported on sales slips.

NORTH COAST MANAGEMENT AREAS

	1	2E	2W		3	4	5	6	7	8	9	10
1984	0	2	0	0	2	4	1	0	0	0	0	
1985	0	1	0	1	2	2	1	1	1	0	0	
1986	0	2	0	0	2	1	0	0	2	0	1	
1987	0	3	0	0	4	12	2	1	4	0	1	
1988	4	6	0	1	5	13	3	2	7	0	1	
1989	1	4	0	0	7	12	2	2	4	1	1	
1990	1	8	0	1	6	15	1	1	1	1	1	
1991	3	4	0	3	8	15	3	3	1	1	4	
1992	3	2	0	2	4	8	3	6	2	2	1	
1993	2	5	0	0	7	17	7	10	1	1	1	
1994	0	1	0	2	1	2	7	4	1	1	2	
1995	0	2	0	3	2	5	3	3	0	2	1	
1996	0	1.6	0	3.7	3.4	16.6	13.5	5.2	2	2.1	0.9	
1997	3	1	0	4.5	14.4	4.6	6	6.2	5.8	5.4	1.6	

	TOTALS				
	North Coast (t)	South Coast (t)	Total Coast (t)	ECVI (t)	WCVI (t)
1984	10	13	23	10	2
1985	9	24	32	18	6
1986	8	45	53	34	11
1987	27	102	129	82	20
1988	41	169	210	138	31
1989	34	182	216	153	29
1990	35	161	197	124	38
1991	44	87	131	67	20
1992	33	85	118	57	28
1993	52	93	145	76	18
1994	20	52	72	43	9
1995	20	55	75	47	8
1996	49	85	134	66.6	15.5
1997	52.5	155.5	208	134.6	20.9

SOUTH COAST MANAGEMENT AREAS

East Coast Vancouver Island

	11	12	13	14	15	16	17	18	19	28	29
1984	0	0	2	0	0	0	0	2	6		
1985	0	2	3	1	0	0	1	4	8	0	0
1986	1	4	4	1	1	1	7	5	11	0	0
1987	1	18	14	1	0	1	7	9	29	0	2
1988	1	41	21	2	2	0	8	12	50	0	1
1989	1	43	17	4	1	1	13	34	37	0	1
1990	1	53	6	1	3	4	7	18	30	0	2
1991	2	28	7	0	1	1	6	8	12	0	1
1992	2	14	8	2	1	1	9	6	15	0	1
1993	4	17	9	2	1	3	10	10	19	0	0
1994	2	13	4	1	0	2	5	5	10	0	1
1995	1	25	4	4	0	1	6	2	3	0	0
1996	2.4	34.3	2.9	0.4	0.8	0.9	8.2	8.7	8.7	1.3	0
1997	5.2	62	8.4	4	3.5	3.5	6.1	13.2	22.2	0.5	6

West Coast Vancouver Island

	20	21	23	24	25	26	27
1984	2	0	0	0	0	0	0
1985	5	0	1	0	0	0	0
1986	6	1	1	2	0	1	1
1987	9	0	4	6	0	0	0
1988	8	0	3	10	0	0	10
1989	7	0	6	11	5	1	0
1990	13	2	9	11	1	1	1
1991	4	0	5	7	1	1	2
1992	10	0	2	11	0	3	3
1993	2	1	2	6	1	4	1
1994	2	0	0	4	0	1	1
1995	1	0	1	3	0	1	1
1996	4	0	0.8	7.9	0.6	0	2.2
1997	5.2	0.3	2.6	7.4	2	1.6	1.8

0 = catch reported less than 500 kg.

Note -- sales slips not available for groundfish trawl octopus bycatch

2.7. Abalone Dive (Closed) - R. Harbo

2.7.1 Introduction

All harvest of northern (pinto) abalone, *Haliotis kamtschatkana*, was closed in Pacific fishery waters, effective December 15,1990 (Harbo, 1994). The life history information and discussions of fisheries management are summarized by Sloan and Breen (1988), Farlinger (1990), and Farlinger and Campbell (1992).

2.7.2 Surveys Following the 1990 closure

The abalone surveys prior to the closure are summarized and discussed by Sloan and Breen (1988) and Farlinger and Campbell (1992). Surveys are conducted periodically in different areas to monitor abalone stock status.

Surveys were undertaken in June 1993, in the central coast at Aristazabel Island, the Estevan Group and Banks Island, which found no evidence of abalone stock recovery at indicator sites (Thomas et al. 1996). Surveys in 1994 (Winther et al. 1995), off the southeast coast of the Queen Charlotte Islands, found a decline of 30% in the total abundance of abalone from the 1990 survey (Thomas et al. 1992).

Campbell (1997) discussed possible criteria for reopening the northern abalone fishery in British Columbia.

A survey undertaken in May 1997 in the central coast (Campbell et al. 1998) found a 43% decline in total abalone from the 1993 survey (Thomas and Campbell 1996).

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3.0 ECHINODERMS

3.1. Red Sea Urchins (1997/98) - J. Rogers and S. Neifer

3.1.1 Introduction

The Red sea urchin (*Strongylocentrotus franciscanus*) is one of three sea urchin species historically fished in B.C. waters. Red and Green sea urchins are fished under authority of a limited Z licence, category ZC for Reds and category ZA for Greens. Purple sea urchins were fished under scientific permit from 1990 to 1992.

Sea urchins are harvested for their 'roe' (gonad), which is extracted at processing plants for fresh shipment to markets. Red sea urchins are removed from the ocean floor into net bags by divers using short aluminium rakes. Packer vessels and trucks deliver the fresh product to processing plants. The gonads are extracted, processed, and sold almost exclusively in Japan. A smaller market is developing in other Asian countries and in North America, where the product is sold as "uni". The yield of roe from a whole animal ranges from 5 to 15% of total body weight.

The Red sea urchin fishery began on the South Coast of B.C. in 1978 and expanded to the North Coast in 1984. Fisheries and Oceans Canada (DFO) implemented a limited entry licensing scheme in October 1991, when 102 licences were issued. This was a reduction of approximately 46% from the previous year (Table 3.1.1.). This action was taken to curtail the tremendous uncontrolled growth observed in the fishery. By 1994, licence appeals had increased the number of licences to 110 and this level of participation has remained constant through to the 1997/98 fishery. The overall whole landed value ($/tonne) of red sea urchins remained stable over the period 1989 to 1991, and increased significantly between 1992 and 1994 (Table 3.1.1.). Landed value has fluctuated around $1600/tonne since 1994.

The Pacific Urchin Harvesters Association (PUHA) voluntarily implemented an Individual Quota (IQ) program in 1994 and 1995. DFO supported the program as a pilot in 1996. As a result of the IQ program, speculation on the value of the fishery increased license value and landed value of the product through 1994 and 1995. Value peaked and stabilized by the end of 1996. Fishermen generally began to fish for quality rather than quantity. Over time, the industry has learned to reduce both quota overages and underages. Fishermen and processors are just beginning to work together to ensure product is available to processors at times appropriate for the market.

Under the pilot IQ program, the Total Allowable Catch (TAC) was reduced by two percent of the estimated coastwide TAC was for First Nations food, social and ceremonial purposes. Each commercial licence is allocated 1/110 of the remaining TAC. The fishery is considered data limited and, as such, is managed under a precautionary regime. The industry association is responsible for developing and implementing a third party catch monitoring and validation program to ensure that area quotas and IQs are not exceeded. Further components of this program include an On-Grounds Monitor (OGM) for the fishery in areas north of Cape Caution, and biological sampling and diver survey programs.

Fishery timing and area openings are critical to maintaining optimum value for sea urchin roe and Canada's economic position in the Japanese market. Harvest schedules are determined in consultation with PUHA and sea urchin processors. The South Coast fishery is prosecuted primarily during the period of traditional peak market demand, avoiding mid-year months. The North Coast fishery is scheduled to provide a continuous supply of high quality product. Initial

area quotas were largely arbitrary and precautionary. Since 1995, the quotas for most areas have been based on survey information and catch data from mandatory harvest logs.

In 1997, an 18 month management plan was developed to permit a licencing change from a calendar year to a market-driven year from July through June. The TAC for the 1997/98-management plan was 9,854 tonnes, of which 8,152 tonnes were assigned to North Coast areas and 1,702 tonnes to South Coast areas. This was comparable to the 1996 TAC of 6,625 tonnes for a 12 month fishery. Coastwide landings during the 1997/98 fishery were approximately 8,738 tonnes for the 18 month fishery. Coast-wide landings for the 1996 12 month fishery were valued at $12.3M for landings of 6,410 tonnes. Preliminary figures value the 1997/98 fishery at $14M. In both 1996 and 1997, Red sea urchins ranked second in volume and fourth in value of all invertebrate fisheries prosecuted in B.C. waters. Landed value equated to an average of $1.94/kg paid to the fishermen.

The coast wide TAC for 1998/99 was reduced by approximately 12% from that of the 1997/98 management plan. This was the result of new information with respect to the biology of Red sea urchins, survey results from new areas, improved estimates of harvest areas from harvest logs, and additional information provided by fishermen. Research conducted by DFO Stock Assessment, First Nations and joint scientific research/ Industry surveys, are of vital importance to this fishery as it moves from a precautionary management regime to a biologically based fishery. The 1998/99 fishery will be reported in a later document.

3.1.2 Biological Objectives

The biology of Red sea urchins is still largely unknown. A research subcommittee consisting of PUHA, First Nation's communities, and DFO continues to undertake biological investigations. These include biomass estimates through transect surveys in various locations of the B.C. coast and experimental harvest and study areas where populations are manipulated to examine urchin growth, migration and recruitment. The long term biological objectives of this fishery are to gain a more comprehensive understanding of the life processes of Red sea urchins and to examine the impacts of commercial harvest. A method to accurately determine age has yet to be discovered, although recent work by Thomas Ebert of San Diego State University shows that some Red sea urchins may attain ages as much as 100 years.

Given that we know little about the age of these animals, it may be useful to first assess spatial and seasonal juvenile growth, survival and recruitment. This information could assist managers in determining the appropriate level of fishing pressure by time and area. Juvenile assessment techniques are imperative for fisheries where recruitment is inconsistent throughout the fishing areas. An area devoid of juveniles could indicate that the area is vulnerable to over fishing.

3.1.3 Fishery Management Actions – Table 3.1.6.

Red sea urchin landings were first reported from 1971 to 1977. All harvesting was carried out in South Coast management areas, and participation was very low. Minor landings in the North Coast were first reported in 1986.

Prior to 1982, Red sea urchins were fished under the authority of a C licence, a general purpose licence issued under Schedule II of the Pacific Fishery Regulations. Licence limitation was implemented in 1992, and a Schedule II licence with a ZC tab was required to fish Red sea urchins. Licences were limited to 102, a reduction from a peak of 188 licences issued in 1990.

A minimum size limit of 100 mm test diameter has been in effect coastwide since 1987. When the North Coast fishery opened year-round in 1988, a maximum size limit of 140 mm test

diameter was instituted for Pacific Fishery Management Areas (PFMA) 1 through 10. The maximum size limit was removed in 1993.

In 1987, harvest quotas were set for many South Coast areas and weekly openings were set according to market demand. The North Coast fishery was conducted under an experimental management regime with rotating fishing areas through 1993. No quotas were set.

Fishing notification and catch reporting were required coastwide in 1989. Harvest log sheets and books became mandatory in 1990 and 1991, respectively.

The North Coast fishery was restricted in 1993 following concern for exponential increases in annual catch that peaked at approximately 12,480t in 1992. In 1993, a TAC of 5,443t was allocated for the North Coast and managed by timed area openings. The fishing schedule was modified a number of times in-season to accommodate Industry's need for a consistent market supply and high quality roe. In some areas, fisheries were terminated when large fleets harvested excessive quantities of urchin. High effort in the early months of the fishery (4,536t were harvested by May) resulted in a fishing suspension for the summer months. 907t of the TAC were retained for the fall fishery.

The management scheme employed in the North Coast in 1993 proved cumbersome and did not give fishery managers sufficient control of the fishery. Licence area selection and area quotas based on historic catch levels were imposed in 1994. The total North Coast quota remained at 5,443t, with a further 454t available as exploratory quota.

In 1994, PUHA received consensus from its members to implement a voluntary individual quota system. Since this was self-imposed, DFO approval was not required. Nonetheless, DFO facilitated the process by altering the fishing plan to accommodate PUHA. The program provided improved monitoring of catch and effort and resulted in a more orderly fishery, allowing the industry more flexibility in opening times and locations. Fishermen requested that the coast be divided into a northern and southern area, separated at Cape Caution. This stabilized effort in each area and reduced the amount of vessel running time between openings. Fishermen were required to select either the North Coast area or the South Coast area, and each licence was allocated an equal proportion of the coastwide quota. From the onset of the IQ system, historical concerns with quota overages were replaced with new problems of quota underages. At the end of the season, approximately 816t of product was left in the water. This was the result of "growing pains" in the IQ system, and was made more significant by the slow harvest of geoduck IQs -- some fishermen abandoned their Red sea urchin IQs late in the season in order to complete their more valuable geoduck quotas. These significant underages were not repeated during the 1995 or 1996 seasons. A company hired by the fishermen validated all landings. Fishermen were required to notify the validation company prior to fishing and upon leaving an area. Quotas were not often exceeded as all landings were validated and weights were taken at the dock.

The fishery in the North followed a predetermined schedule of openings. This schedule was developed through consultation with fishermen and processors and was based on stock assessment advice. Once a schedule was drafted and accepted, it was published in the annual management plan. No scheduled fishing dates were moved forward, but if a monthly quota had been achieved prior to the end of that month, fishermen could harvest quota that was scheduled but not taken in previous months.

South Coast fishery managers scheduled openings for the spring and late fall. This schedule remained flexible and actual fishing dates were determined in season, through consultation with the fishermen and processors, to ensure that activity was conducted during periods of strong market demand.

In late 1995, the Minister of DFO sanctioned the IQ management regime for Red sea urchin, Green sea urchin and sea cucumber fisheries. Sanctioning the process allowed DFO to impose license conditions ensuring that all fishermen participated in the quota management program. As a condition of the offer of a quota fishery to the commercial industry, the Minister required that 2% of the TAC be held in abeyance for Aboriginal food, social and ceremonial purposes.

DFO-sanctioned individual quotas were implemented for the 1996 Red sea urchin fishery. Changes from the previously voluntary IQ system were minor and dealt with things like reduced flexibility in quota transfer between vessels in season. A vessel could hold a combination of North and South Coast licences, to a maximum of 3 licenses per vessel. A monthly schedule of openings was set for the North Coast in 1996. PUHA hired a charter patrolman to attend the fishery for 8 months a year. Catch validation at first point of landing was required and an Industry funded monitoring and validation program was developed collaboratively between PUHA, DFO and D&D Pacific Fisheries Ltd.

In 1997, an 18 month fishery was scheduled to facilitate a change from a calendar to a market-driven year. In future, the fishery will run from July 1 to June 30. As a result of new stock assessment advice, the South Coast quota was reduced and the North Coast quota increased by the equivalent of two IQs. 91 IQs were assigned to the North and 19 IQs to the South. The North Coast harvest schedule was refined to permit area changes every 2 weeks in some months. The Stock Assessment Division harvest log and the service bureau validation log were amalgamated into one document. Chart records of fishing areas were also required.

As more information becomes available through surveys and increasing industry experience, quotas will be modified to better reflect relative abundance and optimum timing for roe quality by area. This process is expected to take a number of years.

3.1.4 Catch and Effort

In the 1980's area quotas on the South Coast were set at 5% of the surveyed biomass. This was then extrapolated to include areas where surveys were not conducted. As the fishery area expanded, quotas were based on estimates of standing stock determined through consultation with fishermen. Scheduling fisheries and defining quota areas became increasingly complex. In 1996, there were 23 South Coast quota areas (a group of Areas, Subareas or portions of Subareas where boundaries define an area to which a quota is attributed) fished during 18 openings. In the North Coast, 33 quota areas were fished during 36 different openings. In 1997/98, 14 South Coast quota areas were fishing during 69 openings and 45 North Coast quota areas were fished during 106 openings.

Prior to the implementation of the IQ program, days fishing per week were limited to 2 or 4 days in the January and February fisheries in Areas 12 and 13. After IQ implementation (starting with summer fisheries in 1994), an area was left open until the quota was achieved. This was made possible through the use of the validation company landing, daily catch and fishing activity records. The duration of North Coast openings was determined in consultation with Industry.

Table 3.1.1. shows annual quotas, catch, value and fishing effort. The data has been split to show the difference between sales slip and harvest log figures. This data has then been used to present effort by fishing day and by diver hour. All information in this table has been verified and corrected to historical sales slip and harvest log databases. CPUE (t/vessel day) gradually increased from 1986 to 1993, and decreased to a constant level subsequent to the implementation of the IQ program. Effort measured in kg/diver hour also appears to have decreased to a constant level with the IQ program. It is of note that most of the fleet is now directed by buyers, and we believe that the effort data as presented is not a true representation

of the effort on the grounds. It may be appropriate to remove this information from future updates.

Figures 1 through 3 are pictorial representations of historical landings and value, and landings by PFMA for 1997/98.

Tables 3.1.2. to 3.1.5. show annual landings by management area and landings by month for the 1997/98 fishery. The 1971 through 1993 data are from DFO sales slips. The 1994 through 1997/98 data are from Validation & Harvest logs, collated by D & D Pacific Fisheries Ltd and the DFO Shellfish Data Unit.

Total annual landings in B.C. fluctuated between 1993 and 1996. This was due largely to quota reductions in the South Coast, although Industry has better organised itself to complete those quotas previously unfinished at the start of the new IQ program.

The total number of licenses with Red sea urchin landings has fluctuated between 108 and 110 since 1994. There are currently 110 licenses eligible to harvest Red sea urchins.

The sanctioned IQ program required that individual vessel quotas remain equal. In 1996, the quota was 60.2 t (132,763 lb.) per license. South Coast fishermen voluntarily elected to divide their IQs into Mainland and East Coast Vancouver Island - Areas 11 to 19, 28 and 29; 40.6 t (89,452 lb.) and West Coast Vancouver Island (WCVI) - Areas 20 to 27; 19.6 t (43,311 lb.). In 1996, the WCVI fishery was poorly attended due to reported poor quality. Flexibility in the plan still only produced a harvest of 58% of the quota in this location. This area was the contributor to an underage of 192.9t in the South Coast in 1996.

The IQ for the 18 month 1997/98 fishery was 89.6 t (197,439 lb.), compared to the previous 12 month fishery 60.2 t (132,777 lb.). South Coast licence holders once again elected to split their IQs between East Coast and West Coast Vancouver Island areas. Fishermen were permitted to fish up to 21.8 t (48,018 lb.) on the East Coast and 67.8 t (149,421 lb.) on the West Coast. South Coast licence holders also developed a protocol for quota area openings that gave them a little more flexibility to move throughout the season.

3.1.5 Stock Assessment Activities

In 1995, the PUHA research fund was established. DFO, PUHA and First Nations joint stock assessment activities continue coastwide with biomass transect surveys, experimental harvest sites, and selected study sites. PUHA and Aboriginal communities supply vessels and divers, and DFO develops the survey protocol and conducts the data analysis. The main survey goals are to prove and/or adjust quotas accordingly, and to better understand the growth and recruitment potential of Red sea urchins.

There is a still a need for more basic biological information in support of management of this species. Industry continues to complain that the 100 mm minimum size limit is too restrictive as the 85 to 100 mm size category is the most desirable to the market. Population data supporting a North Coast quota is required. The North Coast ceiling is a contentious issue as there is no strong biological basis for it. First Nations continue to question the sustainability of this quota.

PUHA continues to support and participate in growth and mortality studies. Biomass information from co-operative surveys in the North Coast and bed areas provided by commercial fishermen are being examined and presented in PSARC working papers.

A portion of Red sea urchin management Area 24D on the south east coast of Vargas Island in Clayoquot Sound has been set aside as a research area. The harvest was restricted so as to provide population data for DFO. Several areas were extensively surveyed, and experimental

areas were harvested using a variety of size limits to assess the effect on recruitment patterns. Another such location in Area 12 (near Plumper Island) was set aside for study in 1994.

Research areas were also established in co-operation with PUHA, the Haida Fisheries Program and the Kitasoo Fisheries Program in Cumshewa Inlet, Queen Charlotte Islands (Subarea 2-3), and on West Price Island (Subarea 7-31). Experimental harvest treatments using different size limits have been conducted and reaction at the sites will be monitored. Chemical tagging was also completed at these sites in 1996, so they will be excluded from commercial harvest for at least 10 years.

3.1.6 Stakeholder Participation

The Pacific Urchin Harvesters Association (PUHA) was established in 1993, and since that time has been instrumental in management plan and research plan development. Annual harvest schedules are developed in consultation with both fishermen and processors. PUHA hires a charter patrolman for 8 months a year to monitor and guide the harvest in the North Coast. A third party catch validation company is hired by industry to monitor fishing activity and landings. PUHA also hires a biologist to plan and oversee co-operative surveys throughout the year.

Several coastal First Nations contribute time and expertise to research surveys by way of biologists, vessels and divers.

3.1.7 Enforcement Concerns

Harvest of undersize urchins remains the largest concern in this fishery. The roe found in smaller urchins has a higher value due to market demands.

There appears to be very little illegal harvest of other species by the Red sea urchin industry. When the IQ program was implemented, PUHA hired an On-grounds Monitor for the northern fleet. This patrol vessel follows the fleet for eight months of the year and ensures that regulations and data requirements are adhered to on the grounds.

3.1.8 Priority Issues

- Basic biological information in support of the management of this species.
- Increase monitoring of the commercially harvested populations, through both surveys and port monitoring. Maintain a time series of data on unfished, moderately fished and potentially overfished areas to better understand the influence of varying exploitation rates on the resilience of local populations.
- Make improvements to the IQ Program to address: distribution of fishing effort; quality-oriented harvest; continuous market supply; and maintaining competitive access to the Japanese market.
- Maintain flexibility in management plan development to incorporate new initiatives into the fishery. For example, with DFO's approval, PUHA implemented a voting system to try and improve the fishing pattern and control the harvest rate. Unfortunately, all fishermen did not adhere to the voting system, and there remains the need for a harvesting protocol that will satisfy both DFO and Industry requirements.

3.1.9 Priority Issues Raised Since the 1997/98 Fishery

- Work toward quantifying commercial fishery mortalities – loss through testing of quality prior to harvest, breakage during sorting on deck, dumping of undersize product, breakage during transport.
- Address and evaluate the impacts of commercial Red sea urchin fishery on the ability of First Nations to harvest for food, social and ceremonial purposes.

Table 3.1.1. Annual red sea urchin landings (tonnes), value and effort for British Columbia, 1978 to June 1998, as reported on sales slips and harvest logs.

					SALES SLIP DATA					HARVEST LOG DATA		
Year	Licences Issued	Vessels with Landings	South Coast Quota[1] (t)	North Coast Quota (t)	Coastwide Landings (t)	Landed Value ($)	Total Vessel Fishing Days	Whole Landed Value ($/t)	X CPUE (t/vessel day)	Coastwide Landings (t)	Total Diver Hours[3]	X CPUE (kg/diver hr)
1978	C	4			75	16,000	54	213	1.4	-	-	-
1979	C	29			317	76,000	298	240	1.1	-	-	-
1980	C	18			333	84,000	331	252	1.0	-	-	-
1981	C	18	136		116	34,000	127	293	0.9	-	-	-
1982	C	21			160	56,000	195	350	0.8	45	76	-
1983	Z 64	36			982	357,830	757	364	1.3	720	1,428	504
1984	Z 85	47			1,764	712,246	1,058	404	1.7	1,377	3,782	364
1985	Z 86	46	1,803		1,815	763,461	1,126	421	1.6	1,204	2,882	418
1986	Z 103	67	1,500		2,067	1,010,758	1,534	489	1.3	1,582	3,397	466
1987	Z 184	97	1,633		2,223	1,275,575	1,737	574	1.3	1,436	3,429	419
1988	Z 184	84	1,678		2,115	1,238,182	1,239	585	1.7	1,764	5,057	349
1989	Z 240	109	1,644		2,658	1,631,471	1,542	614	1.7	2,005	5,409	371
1990	Z 188	116	1,668		3,158	1,952,998	2,651	618	1.2	2,440	7,479	326
1991	Z 102	89	1,531		6,945	4,187,086	3,862	603	1.8	6,427	16,356	393
1992	Z 108	110[2]	1,554		12,982	8,661,504	6,222	667	2.1	12,480	31,170	400
1993	Z 107	103	1,401	5,443	6,388	5,372,684	3,364	841	1.9	6,106	17,202	355
1994	Z 110	98	1,543	5,897	5,829	8,066,381	3,978	1,384	1.5	5,960	18,942	315
1995	Z 108	108	1,387	5,455	6,585	11,349,813	4,167	1,724	1.6	6,807	21,398	318
1996	Z 109	109	1,265	5,360	5,753	11,358,152	3,536	1,974	1.6	6,410	18,046	355
1997/98[3]	Z 110	109	1,702	8,150	8,448	13,993,831	5,305	1,656	1.6	8,738	30,223	289

[1] South coast quota includes exploratory areas; North Coast quota new in 1993.

[2] Larger than the number of licences issued due to licence transfers.

[3] Change in licencing from calender year to market-driven year. 1997/98 season ran January 1/97 to June 30/98.

Table 3.1.2. Summary of red sea urchin landings (tonnes) by South Coast Management Area 1971 to June 1998, as reported on sales slips and harvest logs. 1994 to 1998 catch data corrected to use validation and harvest logs only.

	SOUTH COAST MANAGEMENT AREAS																		
	East Coast Vancouver Island											West Coast Vancouver Island							
Year	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27	Annual Landings
1971 to 1973[1]									110.0						254.0				364
1974 to 1977[1]		1.4		*	*	1.4			66.0			*		1.3					70
1978			*						46.0			29.0							75
1979			*	78.0			57.0	133.0	45.0			1.8	0.9	2.5					318
1980				18.0			162.0	54.0	97.0			1.8							333
1981			20.0	4.0	*		5.3	47.0	22.0						17.0				115
1982		2.5		46.0			0.8	11.0	94.0						5.0				159
1983[2]	7.8	99.0	264.0	260.0	*	*	59.0	38.0	112.0			24.0		22.0	38.0		62.0		986
1984	0.3	437.0	777.3	172.0			33.0	67.4	76.3		5.7	69.1		17.3	103.0		3.9		1,762
1985		544.0	492.0	167.0	106.0	5.9	29.0	48.0	77.0		47.0	30.0		96.0	158.0	145.0	15.0	45.0	1,815
1986	27.0	548.0	376.0	178.0	56.0	4.4	57.0	129.0	105.0		2.0	40.0		154.0	285.0		2.5	91.0	2,055
1987[3]	6.9	420.0	491.0	193.0	32.4		71.0	71.0	123.0	17.0	7.8	17.0		63.0	199.0	95.0	8.3	12.0	1,827
1988	2.6	534.0	480.0	78.0	21.0	2.3	*	22.0	78.0			74.0		13.0	250.0	66.0		58.0	1,679
1989		569.0	493.0	122.0	6.7		9.0	64.0	57.0		1.6	15.0			223.0	39.0		86.0	1,685
1990	84.8	437.6	428.4	56.6	1.2	0.6	43.0	46.5	58.6	0.3	1.8	7.9		59.7	215.1	56.8		68.1	1,567
1991	36.4	358.7	370.7		8.6		26.6	94.8	27.2		14.1	31.2	2.7	58.4	185.1	115.8		121.1	1,451
1992	8.0	531.0	320.0				103.0	36.0	86.0		4.0	56.0	9.0	31.0	200.0	10.0		65.0	1,459
1993	55.5	329.0	184.0				21.0	104.7	17.3			14.5		40.4	92.0	7.0	2.0	50.0	917
1994	17.0	348.0	168.0				4.0	59.0	14.0		1.0	3.0		54.0	111.0	50.0		49.0	878
1995	34.0	364.0	175.0				28.0	69.0	15.0		9.0	20.0		57.0	199.0			98.0	1,068
1996	38.0	344.0	238.0				25.0	112.0	7.0		10.0	33.0		46.0	122.0			70.0	1,045
1997/98	61.0	594.0	426.0		2.3		26.0	67.0	40.0		16.0	32.0		54.0	132.0			85.0	1,535
1971 to June 1998	379	6,271	5,703	1,373	234	15	759	1,273	1,373	17	120	499	13	770	2,788	585	94	898	23,165

* Less than 500 kg.

[1] Data for each year cannot be published separately.

[2] Mandatory log book under Z licence came into effect in 1983.

[3] Sales slips were combined for sea urchins in 1987, were later separated by price criteria, but 320 t remains missing in area table. See Table 3.1.1.

Table 3.1.3. Summary of red sea urchin landings (tonnes) by North Coast Management Area 1984 to June 1998, as reported on sales slips and harvest logs. 1994 to 1998 catch data corrected to use Validation & Harvest logs only.

	NORTH COAST MANAGEMENT AREAS											
Year	1	2E	2W	3	4	5	6	7	8	9	10	Landings
1984	2.2											2.2
1986											12.0	12.0
1987					23.0			179.0	91.0			293.0
1988					73.0	11.0	7.3	314.0	32.0			437.3
1989	0.2	223.0		1.6	116.0	1.3	168.0	217.0	65.0		180.0	972.1
1990		26.6	10.7	24.5	156.8	265.3	67.1	1,040.1				1,591.1
1991		333.1	2.7	143.3	1,026.7	2,577.3	77.7	774.7	114.6	24.5	304.9	5,379.5
1992		1,111.0		1.0		3,294.0	4,063.0	2,763.0	140.0	114.0	38.0	11,524.0
1993	97.0	189.0	88.9	12[illegible]	1,008.0	463.0	2,103.0	1,012.0	43.4		215.3	5,346.8
1994	221.0	402.2	167.4	173.0	687.0	1,056.0	1,244.0	861.0	57.0	46.0	164.0	5,078.6
1995[1]	258.0	440.2	256.3	48.0	940.0	1,280.0	1,053.0	1,076.0	111.0	49.0	224.0	5,735.5
1996	259.0	365.0	241.8	66.0	851.0	1,156.0	1,213.0	833.0	122.0	10.0	248.0	5,364.8
1997/98	582.0	718.7	311.1	62.0	1,076.0	1,107.0	2,175.0	870.0	112.0	41.0	152.0	7,206.8
1984 to June 1998	1,419.4	3,808.8	1,078.9	646.6	5,957.5	11,210.9	12,171.1	9,939.8	888.0	284.5	1,538.2	48,943.7

[1] Area 106 = 115.31

Table 3.1.4 Summary of red sea urchin landings (tonnes) by South Coast Management Areas in 1997/98 as reported by on Validation & Harvest logs.

	SOUTH COAST MANAGEMENT AREAS																					
	East Coast V.I.												West Coast V.I.									
Month	11	111	12	13	14	15	16	17	18	19	28	29	20	21	23	123	24	124	25	26	27	Monthly Totals
Jan			136.0	176.0																		312.0
Feb	8.0	2.0	23.0	23.0													65.0	1.0			2.0	124.0
Mar	14.0	3.0															39.0					56.0
Apr	3.0		4.0														5.0					12.0
May			7.0																		21.0	28.0
June			18.0	40.0																		58.0
July																						
Aug			28.0																			28.0
Sept			85.0	5.0													4.0					94.0
Oct			41.0												9.0		2.0					52.0
Nov			41.0												38.0	7.0	6.0				21.0	113.0
Dec			79.0	27.0				23.0	57.0	20.0		8.0	23.0				9.0				23.0	269.0
Jan			52.0	108.0					5.0	2.0			3.0									170.0
Feb	17.0		51.0	47.0					4.0	18.0												137.0
Mar	14.0		15.0					2.0				8.0	6.0								17.0	62.0
Apr			4.0																			4.0
May			9.0																			9.0
Jun																						
Area Totals	56.0	5.0	593.0	426.0				25.0	66.0	40.0		16.0	32.0		47.0	7.0	130.0	1.0			84.0	1,528.0
	Mainland and East Coast Vancouver Island Total: 1,227.0												West Coast Vancouver Island Total: 301.0									
																					South Coast Total: 1,528.0	

Table 3.1.5 Summary of Red Urchin landings (tonnes) by North Coast Management Areas in 1997/98 as reported on Validation & Harvest logs.

	NORTH COAST MANAGEMENT AREAS													
	QCI			NC Mainland										
Month	1	101	2	3	4	5	105	6	106	7	8	9	10	Monthly Totals
Jan								206.0		2.0				208.0
Feb			1.0					419.0	12.0					432.0
Mar				12.0	235.0	133.0		10.0						390.0
Apr	249.0	33.0	553.0					27.0	2.0					864.0
May								75.0	20.0				12.0	107.0
June						1.0				96.0				97.0
July					55.0									55.0
Aug						226.0	3.0							229.0
Sept					148.0					56.0	57.0			261.0
Oct								260.0		163.0		41.0	74.0	538.0
Nov					62.0	350.0		211.0		62.0				685.0
Dec					71.0	350.0				134.0				555.0
Jan								353.0						353.0
Feb								320.0	96.0					416.0
Mar				29.0	421.0			19.0		138.0	54.0		49.0	710.0
Apr	300.0		476.0	5.0	14.0									795.0
May				16.0	70.0			40.0	106.0	219.0				451.0
Jun						44.0							17.0	61.0
Area	549.0	33.0	1,030.0	62.0	1,076.	1,104.	3.0	1,940.	236.0	870.0	111.0	41.0	152.0	7,207.0
	QCI Total:		1,612.0	NC Mainland Total:									5,595.0	
				North Coast Total:									7,207.0	

Table 3.1.6. Historical Management Actions in the Red Sea Urchin Fishery

1971-77:	First reported landings of red sea urchins. Participation was very low. All landings from the **South Coast**.
Prior to 1982:	Red sea urchins fished under authority of a 'C' License.
1982 to 1985:	Steady increase in effort and landings under Z licence (1983).
1986:	Minor landings in **North Coast**.
1987:	**Coastwide:** 100mm min. size limit in effect for all areas. Harvest logs and slips required. **North Coast** fishery open year-round, no quotas. Fishery focused on Central Coast due to proximity to South Coast plants. Quotas set for many **South Coast** areas, based on 1981 and 1984 surveys. Harvesting period for South Coast areas reduced to encompass times of highest market demand (October 15 to February 15, Sunday through Thursday). Areas 17, 18, 19 closed until December 8. Voluntary compliance closures for First Nations use.
1988:	Experimental management in the **North Coast**. North Coast fishery open year-round, minimum and maximum size limit, no quotas. Burnaby Narrows (SA 2-13) closed to facilitate exploration (to set boundaries for rotational areas in 1989-90). **South Coast** areas open 4 days/week (Sunday through Wednesday), with the exception of WCVI, open 7 days/week from September 11 to October 15. Total South Coast quota 1,633 t (3,600,000 lb.). plus exploratory fishing.
1989:	**Coastwide:** Fishing notification and catch reporting required. Experimental management continued in the **North Coast**. Minimum and maximum size limit, and rotational fisheries. Areas 1, 2E, 2W, 3, 4, and 6 to 10. **South Coast** openings Sunday through Wednesday at varying periods throughout the year. Total South Coast quota 1,712.3 t (3,775,000 ib.).
1990:	**Coastwide:** Hail and catch reporting required. Harvest log sheets become mandatory. Sales slip requirements defined in plan. **North Coast** fishery open year-round. Area restrictions and 3 year rotational fishery set in Subareas 2-1 to 2-10, 2-42 to 2-67, 3, 4, 5 and 7. Hail and catch reporting required. **South Coast** quotas mostly arbitrary. Area quotas set to limit expansion until stock and biological information is collected and evaluated. Fishery limited to traditional peak market demand, October to February. Openings 4 to 7 days/week at periods throughout the year.
1991:	**Coastwide:** Fishing notification and 1991 Harvest Logbooks required coastwide. Licences limited to 102 (October 21/91). **North Coast** effort and landings increased significantly. Research requested in support of lowering the size limit. Rotational fishery January 7 to December 31. Subareas 2-1 to 2-10, 2-63 to 2-84, 3, 4, 5, 6-18 to 6-20, 6-24, 6-25, 7-25 to 7-28, 8, 9, 10. **South Coast** openings varied throughout the year. Total South Coast quota 1,542.2 t (3,400,000 lb.).
1992:	**Coastwide:** Licence limitation in place. Schedule II with a Z-C licence required. Notification, catch reporting and catch and fishing data requirements. **North Coast** closures considered for First Nation allocation. Areas 2-1 to 2-10, 2-63 to 2-84, 5-13 to 5-22, 6-9, 6-13, 6-16, 6-11, 6-14, 6-15, 6-17, 7-31, 7-18, 8, 9. **South Coast** openings built around markets. Most openings for 4 days/week. Additional exploratory areas implemented for WCVI. New closures in Areas 14, 15, 16.
1993:	**Coastwide:** Landings monitored at first point of landing. Pacific Urchin Harvesters Association (PUHA) steering committee established. **North Coast** quota capped at 5,443.2 t (12 mill. lb.). Reductions in NC quota are anticipated. Rotational areas. Three fishing periods: Jan. to May, June to Aug., Oct. to Dec.. Areas 1-3, 1-5, 1-7,

2-12 to 2-19, 2-31, 3-1, 4-1, 4-5, 4-9, 4-13, 7-12, 7-20 to 7-24, 7-32, 6-5, 6-10, 6-11, 6-13, 106-2, 4-2 to 4-4, 4-9, 5-11. Maximum size limit removed.

South Coast area, openings and quota changes. All South Coast areas open Monday through Thursday. Quota lowered due to overages in the 1992 season.

1994: **Coastwide:** Expansion of management plans to include Enforcement Plan, Aboriginal Fisheries Strategy section, and Sport Fishing Plan. Area licencing – North and South Coast, divided at Cape Caution. One year licence area selection. Voluntary Individual Quota (IQ) program instituted by Industry. Landings validated by a company hired by PUHA. New logbook requirements. Export requirements.

North Coast quota 5,443.2 t (12 mill. lb.) with 453.6 t (1 mill. lb.) for exploratory fishing. New timing and allocation of quota to areas.

South Coast quota 1,315.9 t (2.901 mill. lb.) with 226.8 t (500k lb.) for exploratory fishing. New closures and study area.

1995: **Coastwide:** PUHA research fund established; validation and catch reporting program established with D & D. New closures in **North Coast.** Quota 12 mill. lb. Schedule of openings established to disperse the fishery throughout most of the year to meet market demands. Voluntary IQ program retained and charter patrolman, paid for by fishermen, on the grounds for catch validation from Jan. to Apr. and Oct. to Dec.

South Coast quota reduced for an overage in 1994. Quota 1,83.7 t (3,051,000 lb.).

1996: **Coastwide:** Two year pilot of individual licence quotas (IQs). Commercial allocation of 6,624.4 t (14,604,000 lb.) divided equally among 110 licence holders. Individual quotas equal 1/110 of the TAC or 60.2 t (132,763 lb.). Up to three licences may be designated to any one vessel. All red sea urchin licences, excluding Native Band licences, are transferable.

Two licence areas. Annual area selection. Fixed number of licences assigned to each area. Vessel length restrictions waived for the duration of the pilot.

Industry funded catch monitoring and validation program developed collaboratively between PUHA, D & D and DFO. Catch validation at first point of landing required. All urchins must be offloaded at a designated landing port. Red urchins must be weighed and validated by a D & D observer at the time of offloading. Fishing notification requirements. Quota overage, transfer and relinquishment requirements. New research area closures.
North Coast quota 5,359.7 t (11,815,907 lb.). Schedule of openings. Charter patrolman on grounds for 8 months.

South Coast quota 1,264.6 t (2,788,023 lb.). Min. 4 vessels fishing before an area opened.

1997/98: **Coastwide** pilot of individual licence quotas (IQ's) continues. Catch validation at the first point of landing by Observers required. Commercial allocation of 9,851.4 t (21,718,290 lb.) divided equally among 110 licence holders. Individual quotas equal 89.6 t (197,439 lb.) per licence.

Decrease in TAC for the South Coast area. Two quotas reassigned to the North Coast. 91 quotas assigned to the North Coast and 19 quotas to the South Coast.

18-month fishery January 1, 1997 to June 30, 1998 to facilitate a change to a biological rather than calendar year. Beginning in 1998, the licence year for this fishery will begin July 1 and end June 30 the following year. Harvest log and the Validation log amalgamated into one document. Fishermen required to submit Harvest information with every validated delivery. Chart records required within 28 days of the previous month's fishing.
Up to 0.09 t (200 lb.) quota overage permitted. Program to carry-over quota overages implemented as a disincentive for excessive overages. Quota overage to be deducted from the licence tab quota in 1998/99.

Harvested urchins in any type of enclosure left unattended in the water must be properly labelled.

Four new area closures in effect in Subareas 17-4 to 17-9, Subareas 18-7 and 18-8, a portion of Subarea 5-10 and portions of Subareas 24-9 and 24-11.

3.2. Green Sea Urchins (1997/98) - G. Parker

3.2.1 Introduction

3.2.1.1 Biological information

Many questions related to the biology of Green sea urchins (*Strongylocentrotus droebachiensis*) in British Columbia remain to be answered. Green sea urchins are broadcast spawners and generally spawn from February to April, although there are indications that West Coast Vancouver Island stocks may spawn earlier in the year. The larval period is dependent on environmental factors such as water temperature and varies from 4-6 weeks. Growth rates are highly dependant upon food availability. Roe quality is strongly correlated to diet and food availability. It is estimated that Green urchins may live to 10 yr. of age based on East Coast studies by S. Robinson. Anecdotal information from fishers suggests that Green sea urchins may be more mobile than red urchins, changing depths and locations over short periods of time.

3.2.1.2 Fishing History

Divers have harvested the Green sea urchin since 1987 under authority of a separate category Z-A licence introduced in the fall of 1988. The number of vessels participating in the fishery peaked in 1989 at 110, which lead to the introduction of limited entry fishery in 1991. There are currently 49 eligible licences for this fishery. A voluntary individual quota (I.Q.) was implemented by fishers in 1994 and was approved by DFO in the fall of 1995. The licence year was changed to better represent the fishing season and now runs from June 1 to May 31 the following year.

Green sea urchins are exported whole and live to Japan to be processed for roe. In 1997/98, six companies shipped a total of 160 tonnes (t) of Green sea urchins overseas (Table 3.2.1.). A processor can pack about 10,000 lb. (4.5 t) of Green sea urchins in 2 hr for air shipment. Many processors undertake a test for roe recovery before shipping. The sea urchins reach Japan about three days after harvest, and once processed, the roe can be held up to 15 days before it is marketed. Green sea urchins are graded A-B (orange-yellow) or C-D (brown-dark brown), depending on colour and roe recovery. There is 15% recovery (roe wt./total wt.) overall, but only about a 6% recovery for the A-B grade.

The landed value per tonne of Green sea urchins increased slightly during the 1997/98 season to about $3.00 per pound, an increase of about $0.60 per pound from the previous season. Preliminary data shows that the value of the overall fishery was roughly 1.06 million dollars.

3.2.2 Fishery Management Objectives

Objectives Specifically for the Green Sea Urchin Fishery:

1. Continue to develop joint Industry and DFO programs for the collection of stock assessment data necessary for the management of the Green sea urchin fishery.
2. Identify closed reference areas for potential brood stock protection and for monitoring the health of the stocks.
3. Identify areas to be used as experimental survey sites. These areas should be used to further expand knowledge about Green sea urchin biology, management, and habitat.

4. Identify areas that may be significant for aquaculture / enhancement experiments or pilots. Designate aquaculture areas where the commercial fishery may be limited in the future.
5. Identify areas to investigate the settlement of juvenile Green urchins on collectors. Develop an assessment strategy to determine the impact of the collection of wild sets of Green urchins by prospective aquaculturists on the wild stocks and other fisheries.
6. Continue to monitor catch and effort, and continue to analyze harvest logbook information.

3.2.3 Management Actions

The Green sea urchin fishery continues to be managed using a minimum size limit, restricted fishing seasons, and area closures. A minimum size limit of 55 mm across the test (shell), excluding the spines has been a condition of the Z-A licence since 1988. This allows animals to spawn at least once before they are harvested and protects a portion of the population from harvest. The size limit regulation was set in February of 1993.

Hand picking by divers is the only harvest method allowed. Suction devices or trawls used in other jurisdictions are not permitted in this fishery. Most of the harvest of Green sea urchins occurs in depths of 10 to 40 ft. by small vessels using either SCUBA or surface supplied air for divers. The fishery has changed and groups of vessels, and vessels with multiple licences, fishing more remote areas with a packer are now more common.

A recent change in the licencing year, June 1 to May 31 now allows the fishery to be open through Christmas and New Year's holidays to take advantage of peak market demand.

Since the introduction of individual quotas during the 1995/96 season, 2% of the total annual allowable catch (TAC) has been removed and held in abeyance for Aboriginal use.

A summary of management actions in the Green urchin fishery is presented in Table 3.2.2.

3.2.3.1 South Coast Management Changes for 1997/98.

1. A commercial catch ceiling of 166.1 t (366,079 lb.) was set for the South Coast. Quotas set on a statistical area basis was further allocated commercial catch (Table 3.2.3.). Quotas were based on advice received from DFO Stock Assessment and the Pacific Stock Assessment Review Committee in a paper by Perry and Waddell (1996; PSARC I96-09).
2. A two year management plan was developed in consultation with Industry and First Nations. The plan was be in effect from October 15/97 to May 31/98.
3. Vessel masters began submitting harvest charts to dock side validators at the time of un-loading. This was implemented to increase ease and compliance in meeting harvest chart requirements.
4. Random biological samples were taken from every commercial dockside validation.
5. Changes were made to the boundary descriptions of the Pacific Rim National Park.
6. The fishery was limited to Areas 11, 12, 13, 17, 18, 19, 20 and 28. Other areas of the coast may have been opened upon request, to be fished under an exploratory protocol developed by DFO, fishers and other interested parties.
7. The length of the fishery was increased by one month, November 10/97 March 15/98 inclusive.

3.2.3.2 North Coast Management Changes for 1997/98

North Coast regions remained closed to commercial fishing except for applications under an exploratory protocol. No applications were made to fish in North Coast areas during the 1997/98 season.

Discussions with industry took place in the spring of 1998 to arrange for North Coast biomass surveys to be conducted in the summer of 1998.

3.2.3.3 Closures

There are a number of small closures described in the Fishery Management Plan, primarily marine parks or areas of interest to sport divers. There is a research closure at Barnfield, Stubbs Island, and a portion of the Plumper Islands, and several closures for native allocation.

3.2.4 Catch and Effort

The number of diving hours decreased slightly for the 1997/98 season while at the same time average diver CPUE increased from 65 to 82 kg/hr. (Table 3.2.1.). Divers report that this is due to increased stock abundance in many areas of the coast. Twenty-seven vessels, with a total of 49 licences, fished during the 1997/98 season. Most fishers chose and fished only one area to obtain their quota. The majority of fishers concentrated their effort in the northern Vancouver Island areas contributing to lower catches, and unfinished quotas in the south.

3.2.4.1 South Coast

The fishery opened on November 10, 1997 and was scheduled to close March 15, 1998 or upon completion of quotas. Quotas were still not completed in Areas 17, 20, and 28, with over 5.9 t (13,000 lb.) of the commercial allocation unharvested. Landings from the South Coast over time are given in Table 3.2.4.

Table 3.2.5. presents South Coast landings by month for 1997/98. Logbook landings for 1997/98 show that the majority of the landings were in December and January. This reflects the choices made by fishers to hold quota until peak market times. Peak prices have been paid in past years in late December, early January.

3.2.4.2 North Coast

Table 3.2.6. presents North Coast landings over time. There were no landings on the North Coast in 1997/98.

3.2.4.3 Catch per unit effort (CPUE)

There was an increase in the vessel CPUE (t/vessel day) during 1997/98, rising from 0.33 t/day in 1996/97 to 0.38 t/day (Table 3.2.1.). This increase is partially due to more fishing boats operating with multiple licences on board a single vessel. Catch rates reported by diver hour also increased in catch per unit effort rising from 65 kg/hr in 1996/97 to 82 kg/hr. Ten licence quotas were not completed during this season.

3.2.4.4 Deep diving

Divers were reported to be diving to 100 ft during the 1997/98 season, although harvest log data show the majority of diving takes place in less than 40 to 45 ft. Generally the urchins were poor quality from deeper depths. Information from fishers suggests that

because of the poorer quality in deep waters, divers focused more on searching for better quality in shallower waters.

Japanese processors complained, in 1993, that roe yields were down to between 4% and 7%; significantly lower than the 10% yields in other years. Divers in that year were fishing deeper in many areas (particularly Knight's Inlet) where quality was poor.

3.2.5 Stock Assessment Activities

During 1997 and early 1998 the Stock Assessment Division of Fisheries and Oceans has been involved with collection and analysis of harvest logbook information from the commercial fishery. At the start of the 1996/97 fishing season, a new combined validation and harvest logbook was introduced. Maps of fishing locations were also collected by the Shellfish Data Unit and keyed into the harvest database so that precise bed locations and populations could be determined and analysed.

Since October 1995 six transect surveys have been conducted in portions of Area 12, and four surveys have been conducted at sites within Area 18. These surveys were carried out with equipment and divers from the West Coast Green Urchin Association, Kwakiutl Territories Fisheries Commission, Cowichan Band First Nations, and DFO. Surveys collected biomass abundance, population characteristics, as well as habitat and distribution information. Results from the October 1995 and March 1996 surveys were recently published by Waddell (1997).

Stock Assessment will be preparing a PSARC paper for January 1999 on the evaluation of recent fishery data incorporating results of recent surveys. Quota recommendations will be provided for South Coast statistical areas using fishery dependant data from the harvest logbook database and fishery independent biomass surveys.

During the summer of 1998, personnel from the Pacific Biological Station also produced a survey protocol for biomass surveys to be conducted in the North Coast Statistical Area. The protocol provided for an independent observer to monitor surveying conducted by fishers at specific sites approved by DFO. A portion of the biomass calculated from the transect survey information will then be allocated to the commercial fisher for harvest.

The Pacific Biological Station is presently collecting Green sea urchin larvae at two sites within Departure Bay in Nanaimo. Collection techniques are being developed in hopes of learning more about the larval distribution of the Green urchin.

3.2.6 Ponding and Aquaculture Initiatives

There is interest in collecting wild sets of Green urchins, impounding, and feeding them. This is being reviewed as part of a policy review for aquaculture of invertebrate species.

There is also interest in harvesting legal size urchins and rearing them until an opportune time comes to market them. There are disease and other transplant concerns related to this. Tenures and kelp harvesting licences may be required from the province.

3.2.7 Enforcement Concerns

The compliance level reported by dockside validators in the Green sea urchin fishery continues to increase. During the 1997/98 season, 96% of all landings were reported as problem free, an increase of 2% from the 1996/97 fishery. The most common infraction continues to be improper or insufficient hail notification to the validation service bureau. Another continuing problem in the fishery is the number of vessels fishing without logbooks present onboard.

Fishery Officers have conducted monitoring of catches in several areas. Generally, compliance to the size limit has been high in recent years but there were instances of small urchins being landed and some charges have been laid. In the past areas have been closed in-season due to conservation concerns (i.e. Kelsey Bay in 1992). The occurrence of undersize urchins suggests that legal-sized urchins are not available due to lack of stock in an area.

In general, management improved in 1997/98 with a more controlled fishery. There were no large quota overages in any of the management areas.

The major enforcement concerns are the monitoring of size limits and ensuring that all product is delivered to a designated landing port to be validated. There is some concern that unlicenced boats may be operating in this fishery.

3.2.8 Priority Issues

- Continue to conduct biomass surveys in both the South and North Coast Areas during the summer of 1998. The condition of the stock along the south end of Vancouver Island continues to be in question. Concerns about over-fishing have been expressed by several fishers.
- There are concerns about fishery data. Fishers maintain that the past harvest log data is incomplete or has been misreported by fishers. This situation been steadily improving since 1995.
- A review of the exploratory protocol developed for fishing in new and previously fished areas is required to ensure accurate information and encourage fisher participation.
- Clear policy and guidelines are required for the ponding and aquaculture initiatives for Green sea urchins. The demands of the aquaculture industry need to be addressed because collecting product that may have an impact on the wild stocks and the fishery quota. The ponding of Green sea urchins creates difficulties in monitoring landings and quotas.
- The industry needs to be encouraged to provide assistance to further develop, compile, and collate biological information on Green sea urchins through fishery and fishery independent means.
- Research is needed to determine how timing and other factors that affect roe quality, texture, colour and size of the gonads.

Table 3.2.1. Green sea urchin landings (tonnes) and effort for British Columbia, 1987 to 1998, as reported on sales slips or harvest logs (87-94) and on validation logs (95-98).

Year	Type and Number of Licences Issued	Number of Vessels with Landings	Fishing Days	Average Fishing Days/ Vessel	Quotas (t)	Landings (t)	Landed Value ($·10³)	Whole Landed Value ($/t)	$\bar{X}$ CPUE[1] (t/vessel day)	$\bar{X}$ CPUE (kg/diver hr)	Total Diver Hours	Total # Divers[3]
1987	Permit 38[2]	20	248	12.4		120	127	1058	0.48	168	729	29
1988	Z 89	68	690	10.1		444	584	1315	0.64	120	2,544	123
1989	Z 191	110	1394	12.7		611	1020	1669	0.44	137	2,997	153
1990	Z 155	90	1352	15.0		475	939	1977	0.35	98	3,568	158
1991	Z 47	47	1348	28.7		607	1795	2957	0.45	93	5,972	133
1992	Z 49	49	2096	42.8		1042	4424	4246	0.50	84	11,412	200
1993	Z 49	53	1631	30.8		721	3777	5239	0.44	64	8623	190
1994	Z 49	48	969	20.2	449*	332	2122	6392	0.34	61	4771	136
1995/96	Z 45	41	551	13.4	173.4* 90.7**	157	1080	6879	0.28	72	2185	88
1996/97	Z 49	30	455	15.2	166.1	150	794 [4]	5291 [4]	0.33	65	2305	77
1997/98	Z 49	27	423	15.7	166.1	160	1060	6612	0.38	82	1958	58

[1] from sales slip data

[2] scientific permits were issued to 38 vessels for fall 1987 to spring 1988 fishery. 1987 landings and fishing days are from harvest logs as green sea urchins were not separated from reds on sales slips until mid 1988. Z licences were issued for the fall 1988 fishery.

[3] data from harvest logs

[4] value estimated from sales slips

* south coast quota only

** north coast quota only

Table 3.2.2. Summary of management actions in the Green sea urchin fishery, 1987 to 1997.

Year	Management Actions
1987	Scientific permits were issued, July 22 to December 31, to fishing vessels for harvest by diving.
	Logbooks were issued with permits to collect data on stock abundance and distribution.
	Permits were limited to the inside waters of Vancouver Island, Areas 12 to 19, 28 and 29.
	Some minor area closures for parks or study areas were in effect as for most dive fisheries.
	A precautionary minimum size limit of 40 mm was set as a condition of the permit.
	Sales slip data did not have a separate species code, so Green and red sea urchin landings are mixed. As a result, landings have been estimated from logbook returns and hails from processors.
	Effort was restricted by limiting the season to the months of traditional peak market demand for sea urchins, Oct.-Dec. and Jan.-Feb. Nineteen vessels reported landings.
1988	Permits were issued for the period Jan. 16 to Feb. 28.
	Sales data for Green sea urchins was recorded with a separate species code.
	A conservative closure was set, Jan. 16 to Feb. 28 in subareas 13-1 to 13-3 due to the intensive fishery in a small area.
	A Z category (Z-A) licence for Green sea urchins was introduced for the fall fishery which opened Oct. 1.
	The minimum size limit was increased to 55 mm test diameter and set as a condition of licence. The season was limited again, Jan. 1-Feb. 28 and Oct. 1-Dec. 31. Sixty-eight vessels reported landings.
1989	The Z-licence, minimum size limit and seasonal restrictions continued.
	A conservation closure was set for subareas 12-1 and 13-29 to 13-40, north of Campbell River, Jan. 31-Feb. 28/89 due to heavy fishing pressure and a high incidence of undersized urchins landed.
	One hundred thirteen vessels reported landings.
1990	The Z-licence, minimum size limit and seasonal restrictions continued.
	There were 91 vessels reporting landings.
	Licence limitation for 1991 was announced with the eligibility criteria of landings of 9,072 kg (20,000 lb.) over the two year period 1988 and 1989. At least 33 vessels were expected to qualify before appeals were held.
1991	Z-Licence limitation - 47 vessels qualified and 47 vessels reported landings.
1992	A South Coast conservation closure was set in the Kelsey Bay area, subareas 12-1, 13-32, 13-33 and 13-35, Feb. 25-Feb. 28. These subareas did not reopen for fall fishing until Dec. 7.
	North Coast fishery open year round, no quotas.
1993	Licences increased to 49. Notification of fishing required. No suction devices. Additional permanently closed areas for parks and reserves, IFF.
	South Coast: Reduced fishing times; Inside waters: season Jan. 4 to Jan. 28, 7 days/wk; Feb. 1 to Feb. 25, 4 days/wk, Mon.-Thurs. Fall fishery Nov. 1 to Dec. 16, 4 days/wk, Mon.-Thurs.; Dec. 6 to Dec. 30, 7 days/wk. Kelsey Bay limited to 7 days, Jan. 4 to 10. W.C.V.I.: season reduced to Oct. 4 to 28, 1992, 7 days/wk.
	North Coast: 7 days/wk, season reduced to Jan. 1 to Feb. 28 and Oct. 1 to Dec. 31. First significant landings, mostly from Area 4.
1994	South Coast: a ceiling catch of 990,000 lb. (449 t) was set along with area quotas. Fishers requested to harvest 25% in Jan.-Feb. and the balance in Nov.-Dec. The days fishing were limited to four days/week (M-R) for some periods and others at 7 days/week.
	North Coast: no quota set; season reduced to periods Jan. 1 to Feb. 28 and Nov. 1 to Dec. 31. Consideration will be given for spring/summer fisheries depending on roe quality and landings.
1995	Fishing licences changed to expire on May 31, 1996.
	South Coast: Individual quota system implemented with port validation. Area quotas also established, with total of 382,276 lb. (173.4 t). Only Areas 12, 13, 17 to 20, and 28 open; other areas available under an exploratory protocol. IQ = 7802 lb. (3.5 t). Research areas identified and closed
	North Coast: No individual quotas. Areas 3 and 4 only open from Nov. 20, 1995 to Jan. 31, 1996, with quota of 200,00 lb. (90.72 t). Other areas open to fishing only under an exploratory protocol.
1996/97	South Coast:

Table 3.2.3. Green sea urchin quotas and landings for the 1997/98 fishing season.

Management Areas	Quota (t)	Quota (lbs)	Landings (t) [1]	Landings (lbs) [1]	Open Times	Closure Date
11	3.0	6,696	2.4	5,210	Nov 10/97	Mar 15/98
12	76.5	168,673	76.5	168,634	Nov 10/97	Jan 16/98
13	39.9	88,020	39.9	87,923	Nov 10/97	Feb 23/98
17*	2.3	5,115	0.7	1,627	Nov 10/97	Mar 15/98
18*	20.0	44,010	16.3	35,889	Nov 10/97	Mar 15/98
19	16.6	36,695	17.4	38,345	Nov 10/97	Dec 31/97
20	6.7	14,670	6.8	14,933	Nov 10/97	Jan 20/98
28*	1.0	2,200	0.0	0	Nov 10/97	Mar 15/98
Totals	166.1	366,079	160.0	352,561		

* quotas not landed
[1] - landings are from validation logs

Table 3.2.4. Summary of green sea urchin landings (tonnes) from 1987 to 1998 for the South Coast of B.C. from sales slips (87-94) or validation logs (95-98).

	PACIFIC FISHERY MANAGEMENT AREAS																		
	East Coast Vancouver Island													West Coast Vancouver Island					
Year	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27	Annual Landings
1987		1.8	58			2.5		4.2	37	17									121
1988	2.8	50.5	168.7	16	8.5	1.2	12	59.8	78.5	20	10	1.4		2.6	4.7	0	4		443
1989		272.1	145.2	1.3			37	75.3	37	6.7	2.5	1		1.1	6.4			12	598
1990	1	160	151	5			2	99	38	4		14		0.5					475
1991	1	241	165	2.8	1.3	0.9	0.6	68	58	5.4	7	51			0.1			2	604
1992	37	639	253	0.3	0.4	5	0.4	28	34		14	30			0.3				1041
1993	8.2	415	81	0.9	1	0.1	0.8	23	60	2.1	1.3	31.6	4		0.4	7			636
1994	2	129	80	1		0.3		23	32		0.2	14							282
1995/96	*	62	54	*	*	*	0.4	13	18		*	6	*	*	0.2	*	*	*	154
1996/97	3.1	76.6	27.2	*	*	*	*	20	16.8		*	6.3	*	*	*	*	*	*	150
1997/98	2.4	76.5	39.9	*	*	*	0.7	16.3	17.4		*	6.8							160
Total 1987 - 98:	57.5	2123.5	1223.0	29.6	11.2	10.0	54.2	429.6	426.7	54.7	35.0	162.1	3.8	4.2	12.1	7.2	4.3	14.3	4663.0

* Areas were closed after 1995 and could only be fished under an exploratory protocol

Table 3.2.5. Summary of Green Sea Urchin landings (lbs.) by South Coast Areas and month in 1997/98, as reported on harvest logs.

	SOUTH COAST MANAGEMENT AREAS							
Month	11	12	13	17	18	19	20	SOUTH COAST (lbs.)
Nov/97	416	9494	1483			1854		13247
Dec/97	1949	91709	17989	602	27517	35995	10200	185961
Jan/98		67431	63531		7533	496	4733	143724
Feb/98	2561		4920	526				8007
Mar/98	284			499	839			1622
Area Totals	5210	168634	87923	1627	35889	38345	14933	352561

** These landings are calculated from harvest logbook records and don't match completely with validater landing records.

Table 3.2.6. Summary of green sea urchin landings (tonnes) by Management Area for the North Coast as reported on sales slips or harvest logs (1987 to 1994) or on validation logs (1995-1998).

	FISHERY MANAGEMENT AREAS										
Year	1	2E	3	4	5	6	7	8	9	10	Annual Landings
1987											0
1988		0.4								0.4	1
1989	12.3					0.7					13
1990											0
1991	0.4					3					3
1992									1.7		2
1993				71	1	4			9	0.1	85
1994				50					0.9		51
1995/96				4							4
1996/97											0
1997/98											0
1987 to 1998	13	0	0	125	1	7	0	0	12	1	159

3.3. Sea Cucumbers - S. Neifer and J. Rogers

3.3.1 Introduction

Little is known of the biology and abundance of sea cucumber (*Parastichopus californicus*) in British Columbia. Commercial exploitation began in 1971 when the first landings were recorded. The fishery has been limited by license regimes in 1983, area closures prior to 1986, the introduction of precautionary area quotas in 1986, license limitation in 1991 and individual license quotas in 1995 (Table 3.3.1). Arbitrary quota reductions have been common place, responding to previous quota overruns and concerns in areas where gear concentrations have occurred. Due to the lack of a solid biological understanding of this species, the Department of Fisheries and Oceans (DFO) has been unable to set defensible quotas and arbitrary quota manipulation has been used in based on anecdotal information and observations.

A personal Z-D licence is required to participate in the sea cucumber fishery. Fishermen using P-licensed (for processing) sea cucumber vessels are restricted to the North Coast and may only process their own catch. The number of eligible Z-D licences was initially limited to 78 but has grown to 85 through successful licence appeals and the addition of 5 band licences issued to First Nations.

The primary product form has been frozen muscle strips. Recently, however, skins have been processed to increase the recovery from this resource. These skins are semi-dried in BC and then either shipped in this form to Asia or sent to dryers in the US prior to export to Asia. Final destinations include Hong Kong, Taiwan, Mainland China and Korea as well as Canada and the US. Dried body wall is another product form of demand and may be introduced as a product from this fishery. The annual landed value of this fishery remains at just under 1 million dollars.

Tables 3.3.2. to 3.3.4. summarise the history of the quotas and landings in the sea cucumber fishery. Quotas and landings are reported in both round and split weights. Since 1992, landings have been split product, and weights are reported as such. PSARC has supported a series of quota reductions since 1986 until more is known about the growth and productivity of sea cucumbers (Table 3.3.4). Each of the two South Coast quotas were reduced from 55 tonnes in 1992 to 27.5 tonnes in 1993 and remained at that level through to 1997 except where quotas were reduced to compensate for previous overages. North Coast quotas were implemented in 1986 with an arbitrary cap of 183 tonnes split weight. In 1989 the North Coast quota was split into three smaller quotas: Central Coast District, Prince Rupert District and the Queen Charlotte Islands District. Fishermen exceeded the quota set for Areas 12 and 13 by as much as 3 times in 1992 (Heizer and Hobbs, 1994). In 1993, the Area 26 and 27 quota was exceeded by 13.5 t and the Area 18 and 19 quota was exceeded by 3.5 t. Overages were deducted in 1994, resulting in a quota reduction to 0 t for the Inside Waters (Table 3.3.2). With the introduction of Individual Quotas (IQ's) in 1995, DFO has cleared any past overages and all areas receive full allocation of quota within the 238 tonne total allowable catch (TAC).

In 1992 and 1993, the open areas in the Central Coast District were restricted in order to move the fishery from heavily harvested locations in Area 7 and to better focus management efforts in-season. In 1994, open areas were restricted in the other North Coast Districts as well (Table 3.3.3).

Six vessels received P-licences in the North Coast in 1990 of which two processed 61 t of sea cucumber. In 1991, 3 P-licences were issued and two vessels processed 41 t. From 1992 to 1997 no P-licences were issued and no processed product was landed. Until the introduction of IQs in 1995, the duration of the fishery had become very short. In 1993, openings were for only

one or two days in all areas except the Queen Charlotte Islands, which was opened for eight days. It is likely that the 'first come, first served' nature of area quotas in this fishery precluded any advantage for processing catch on board. In 1995, with IQ's, the fishery was scheduled to last two weeks in both the North and South coasts. Due to the late opening date, the fishery in the North was open for three weeks to allow for weather related delays. In 1996, the fishery opened for two weeks. The East Coast of Vancouver Island fishery was extended for three days and the Central Coast was re-opened for one day. Both of these extensions were to facilitate completion of quotas for specific licences. In 1997, the fishery was opened for three weeks and all quotas, except for one that was not fished, were completed by the closing date.

There have been two main enforcement concerns in the past with this fishery. The first was pre-fishing where some fishermen would stock pile sea cucumbers prior to the opening as a means to ensure the harvest of a larger portion of the quota. Now that the fishery is operated under individual quotas this practice is of no advantage and appears to no longer occur. The second issue concerned the lack of a sport fishery limit on sea cucumbers. Some fishermen would commercially harvest during closed times and report catch as sport fish. Sport fishing for sea cucumbers was closed coastwide in 1993. Legislation has been changed, and in 1996 a sport fishery was set with a limit of 12 sea cucumber per day, and a possession limit of 24.

3.3.2 Biological Objectives

The sea cucumber fishery is data limited. The Pacific Sea Cucumber Harvesters Association (PSCHA) and DFO have now entered into collaborative agreements that include research components. Shortly after the 1997 fishery, two biomass surveys were completed and experimental harvests done. In conjunction with interested Aboriginal communities, the PSCHA and DFO are moving towards a more biologically based fishery. Fisheries and Oceans Canada and the PSCHA aim to collect fishery data in a way that will test current assumptions of standing stock and productivity.

3.3.3 Fishery Management Objectives

Objectives specific to the sea cucumber fishery developed through Stock Assessment advice and in consultation with industry:

- Determine the specific fishing areas through consultation with industry and Stock Assessment.
- Develop research and fishing protocols that will enable DFO and industry to acquire the needed information for the wild fishery and aquaculture initiatives.
- Collaborate with industry and First Nations to conduct fishery independent biomass assessments and test harvest rates.
- Fish static areas to enable fishery dependent information to be collected and examined to determine harvest impacts within these areas.
- Identify areas to be surveyed. A surveyed area will result in a potential open area with a quota assigned and may also include a potential closed area for reference.

3.3.4 Fishery Management Actions

In 1995, an IQ management regime was implemented in this fishery and a biological consultant was contracted by the PSCHA to validate catch. Fishermen were required to report in to the consultant prior to fishing and were required to have all of their catch weighed and validated. The coast remained divided into five areas and each licence was designated to an area prior to the fishing season. This was accomplished through voluntary area selection and a lottery

process if required. The PSCHA was responsible for ensuring that the area selection process was completed. This system remained in place through 1996 and 1997. The QCI (Queen Charlotte Island) licences were re-designated to either the Central Coast or Prince Rupert District. This licence re-allocation was in response to higher costs associated with fishing and transporting sea cucumbers from QCI. Industry was assured that this area would remain a viable fishing location and that they would have the option to return there once biomass surveys were complete.

In 1997, the quotas for the South Coast increased slightly to 57.6 t. split weight and the North Coast decreased slightly to 175.6 t split weight. These quotas equal the same total coast wide quota of 233 t that has been present in the fishery since 1995. The individual license quota was again 2.74t (6,049 lb.).

DFO is in consultation with Industry to determine means of examining abundance, growth, recruitment, settlement, and mortality in sea cucumber populations. A history of fishery management actions is included in Table 3.3.8.

3.3.5 Catch and Effort

Table 3.3.4. presents the coastwide quotas and landings for the sea cucumber fishery from 1986 to 1997. The pattern of exceeding coastwide quotas, which occurred each year between 1987 and 1993, has not occurred since 1994. Validated landings for 1997 were 231.3 t split weight; 1.9 t short of the 233.3 t quota.

When the IQ program was introduced, concerns for quota overages were reduced and a fixed fishery duration was set. Quotas were achieved in 1997 by all except one license, where a lease agreement dissolved just prior to the opening date and the license was not fished. Minor overages and underages did occur on individual licenses throughout the fishery, but the overall landings were lower than the assigned coastwide quota.

The South Coast quota in 1997 was 57.6 t (127,029 lb.). 57.8 t (127,476 lb.) were landed (as reported on validation logs) by 21 vessels, 16.6 t from Inside Waters and 41.2 t from the West Coast of Vancouver Island (Table 3.3.2.). The North Coast quota was 175.6 t (387,136 lb.) and 173.4 t (382,344 lb.) were landed. A small underage was recorded in Prince Rupert, the result of an unfished license, and a small overage was recorded for the Central Coast. A commercial fishery did not occur on the Queen Charlotte Islands in 1997.

Table 3.3.1. summarises catch, effort and value data for this fishery from 1980 to 1997. Table 3.3.5. gives the fishing times and quotas for 1990 through 1997. Tables 3.3.7. and 3.3.8. show annual landings by statistical area. This data was compiled from sales slip information and validation logs and has been reported in kilograms of round product, kilograms of split and eviscerated product and pounds of split and eviscerated product. The data have been converted to allow comparison of the information by year and area. There is a difference between validated weights of sea cucumber and those weights reported on sales slips.

Preliminary data indicate that the value of the 1997 fishery was approximately $0.780 million. The 1996 fishery was worth $0.894 million whereas the 1995 value was $0.784 million, and the 1994 value was $0.976 million (Table 3.3.1.). Average price paid in 1997 for sea cucumbers was $3.36/kg (split and eviscerated weight). This fishery ranks sixth in value among shellfish species.

3.3.6 Stock Assessment Activities

A review of the available data and the feasibility of an assessment of the stocks and determination of a biologically based quota for this fishery was conducted by Phillips and

Boutillier (PSARC 195-14). Recommendations were made for: improvement of the sea cucumber database; reduction of quota management area sizes; increase in provision of biological information, both from fishery-dependent and independent sources; and the collaboration of DFO and Industry to collect the most useful data possible for the management of this fishery. In this regard, validated landings were implemented and the Validation and Harvest logs were ultimately combined. Preliminary volunteer transect work was initiated but not completed in 1996. Another PSARC paper (PSARC 196-12) was presented, outlining advice on management of the fishery. In 1997, this advice was incorporated into the collaborative agreement between the PSCHA and Fisheries and Oceans Canada, The management plan reflected this move to a more biologically based fishery. A survey protocol was developed and industry initiated the first surveys late in 1997 and into 1998.

3.3.7 Enforcement Concerns

The introduction of IQ management in the sea cucumber fishery has removed the largest enforcement concern of pre-fishing. As there is no size limit in this fishery, area boundaries and licensing are the only enforcement concerns, and problems are minimal. Logbook errors are being addressed through the recent amalgamation of the harvest log with the validation log.

3.3.8 Priority Issues

Little biological data or stock assessment data exists for sea cucumber. The biomass of these animals must be better measured and understood. We need to collect data, both fishery dependant and fishery independent, to ensure that progression of this fishery is biologically based and that harvest levels are sustainable. Significant moves towards these objectives are being made through the recent surveys that the PSCHA has initiated using DFO survey protocols.

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Table 3.3.1. Sea cucumber catch, effort and value as determined from fish slips and validation log data, 1980-1997.

Year	Annual Quota (t)[1]	No. of Licences	No. of Vessels w/landings	Total Fishing Days	Total Landings (t)[1]	Landed Value ($·10³)	Av. Diver day Length (hr)[2]
1980			9	59	7.3		ND
1981			11	ND	9.9		ND
1982			ND	ND	1.8		ND
1983			19	356	193.0		3.4
1984			12	249	41.4	22	3.6
1985		Z 40	21	271	126.7	94	2.9
1986	549	Z 63	34	733	287.9	236	3.1
1987	549	Z 151	56	1906	630.8	768	4.5
1988	549	Z 160	79	1512	704.0	984	2.7
1989	293	Z 245	91	1022	419.0	977	2.1
1990	293	Z 215	126	1153	318.7	1167	2.7
1991	293	Z 78	60	535	490.8	1029	2.6
1992	293	Z 84	77	449	521	1363	3.2
1993	238	Z 84	75	201	298	982	3.8
1994[3]	210.5	Z 85	71	164	196[4]	976	3.8
1995[3]	233	Z 85	47[6]	280[5]	225	784	3.4
1996	233	Z 85	50	167	233	894[7]	3.1
1997	233	Z 85	41	199	231	780	3.7

[1] Quota, landings and CPUE for 1986 to 1991 were reported in round weight. Quota, Landings and CPUE are all converted to split weight

[2] Data from harvest logs.

[3] Data incomplete.

[4] A reported 20,255 lb were spoiled & dumped - it is not yet known if they are included in this number.

[5] AMR estimate

[6] Total number of active vessels does not equal number of vessels per area as several vessels harvested quotas in 2 fishing areas and have been counted twice.

[7] Data Preliminary

Table 3.3.2. The history of quotas, fishing areas and split weight landings in South Coast areas, 1986 to 1997 (from fish slips and validation logs).

SOUTH COAST AREAS

	Inside Waters			West Coast			
Year	Open Subareas	Quota (t)	Landings (t)	Open Subareas	Quota (t)	Landings (t)	Total (t)
1986	11 to 19,28,29	183	284.6	20 to 27	183	3.3	287.9
1987	11 to 19,28,29	183	314.7	20 to 27	183	161.5	476.2
1988	11 to 19, 28, 29	183	227.1	20 to 27	183	264.5	491.6
1989	11 to 13, 18, 19	55	96.0	20 to 27	55	108.1	204.0
1990	11 to 13, 18, 19	55	86.4	20 to 27	55	66.3	152.7
1991	18, 19, 20	55	74.0	25, 26, 27	55	97.0	171.0
1992[1]	12 and 13	55	221	23, 24-1 to -5, 24-10, -12 to -14	55	42	263
1993	18 and 19	27.5	31	26 and 27	27.5	41	72
1994	13A (13-14 to 13-23)	closed	0	23 (all s/a) 24A (24-6, -8 to -12)	27.5	26[2]	26
1995[1]	13B (13-7 to -12, -24 to -43) and area 12 (all s/a)	27.5	28	24B (24-7) and area 25 (all s/a)	27.5	24.7	52.7
1996	18 & 19	27.5	27.3	26 & 27	27.5	27.5	54.8
1997	12A (12-9 TO 111, 13, 16)	11.4	11.1	24A (24-4 TO 6, 14)	7.3	7.6	57.9
	12B (12-4, 7, 8, 17, 40)	13.3	13.6	24B (24-7 TO 10)	9.2	9	
	13A (13-12 TO 16)	9	9				
	13B (13-17 TO 20, 23)	7.5	7.6				

[1] Quotas and landings before 1992 were reported in round weight; all data are converted to split weight.
[2] Hailed catches were 33.6 t.

Table 3.3.3. The history of quotas, rotational fishing areas, and split weight landings for North Coast areas, 1986 to 1997 (from fish slips and validation logs).

NORTH COAST AREAS

	Q.C.I.			Prince Rupert			Central Coast			
Year	Open Subareas	Quota (t)	Landings (t)	Open Subareas	Quota (t)	Landings (t)	Open Subareas	Quota (t)	Landings (t)	Total (t)
1986[1]	1,2E,2W		-	3, 4, 5		-	6, 7, 8, 9, 10		-	-
1987[1]	1,2E,2W		7.0	3, 4, 5		2.9	6, 7, 8, 9, 10		144.3	154.2
1988[1]	1,2E,2W		0.4	3, 4, 5		6.6	6, 7, 8, 9, 10		205.1	212.1
1989	1,2E,2W	59	42.9	3, 4, 5	62	80.6	6, 7, 8, 9, 10	62	91.6	215.0
1990	1,2E,2W	59	27.8	3, 4, 5	62	56.4	6, 7, 8, 9, 10	62	81.3	165.6
1991	1,2E,2W	59	71.0	3, 4, 5	62	117.0	6, 7, 8, 9, 10	62	132.0	320.0
1992[2]	1,2E,2W	59	68	3, 4, 5	62	86	6, 7 (ptn), 8, 9, 10[3]	62	105	259
1993	1,2E,2W	59	67	3, 4, 5	62	81	6	62	79	227
1994	2-12 to 2-14 2-17 to 2-19	59	49	3 and 4	62	56	7-18 to 7-25, and 7-32	62	66	171
1995	ptn. 2E	57.7	48	3 and ptn. 4	60.5	61.1	ptn. 7 and 8	60.5	63.9	173
1996	-	-	-	ptn. 5 & 6	90.7	90.8	ptn. 7	88	86.1	177
1997	-	-	-	5A (ptn. 5 & 6)	26.3	26.4	7A (ptn. 7)	26.3	24.2	173
				6A (ptn. 5 & 6)	61.5	59.2	7B (ptn. 7 & 8)	61.5	63.6	

[1] The North Coast quota was not divided into the three areas until 1989. The 500 t (round weight) quota covered all areas (1 to 10).
[2] Quotas and landings before 1992 were reported in round weight; all data are converted to split weight.
[3] In Area 7, subareas closed were: 7-12, 7-15, 7-17, and 7-22.

Table 3.3.4. Sea cucumber annual quotas, fishing effort, and landings (t) 1986 to 1997 for the entire coast of British Columbia (from fish slips and validation logs).

	Quota			Effort	Landings [1]	
Year	Round (t)	Split (t)	Pieces (#)	Total Fishing Days	Round (t)	Split (t)
1986	1500	549	2.36 M	733	786	288
1987	1500	549	2.36 M	1906	1722	631
1988	1500	549	2.36 M	1512	1922	704
1989	800	293	1.26 M	1022	1144	419
1990	800	293	1.26 M	1153	870	319
1991	800	293	1.26 M	535	1340	491
1992	800	293	1.26 M	449	1422	521
1993	650	238	1.02 M	201	812	298
1994[2]	575	210.5	.88 M	164	536	196
1995	637	233	.97 M	280[3]	615	225
1996	637	233	.97 M	167	636	233
1997	637	233	.85 M[3]	199	631	231

[1] Landings 1986 to 1991 were reported in round weight, 1992 to 1996 were reported in split weight; conversion factor of 2.73 (round to split weight) used. All data are converted to split weight.

[2] Quota was reduced by 27.5 t split weight due to overages in the 1992 Inside Waters fishery.

[3] AMR estimate

Table 3.3.5. Sea cucumber area quotas and fishing times, 1990 - 1997.

Area Description	Year	Statistical Areas	Quota[1] Tonnes	# Pieces	Opening Date	Closing Date	# Days Fishing	Total Landings (t)	Converted to Round Wt2
SOUTH COAST									
West Coast Vancouver Is.	1990	20 to 27	55	236,250	Jan 1	Jan 15	15	66.3	181
	1991	25 to 27	55	236,250	Jan 14	Jan 25	12	97	265
	1992	23 and 24	55	229,167	Jan 15	Jan 23	9	41	112
	1993	26 and 27	27.5	114,583	Feb 2	Feb 3	2	41	112
	1994	23 and 24A	27.5	114,583	Nov 3	Nov 3	1	26	71
	1995	25 and 24-7	27.5	-	Nov 15	Nov 28	13	24.7	67
	1996	26 and 27	27.5	-	Oct 7	Oct 21	14	27.5	75
	1997	ptn. 24	16.5	-	Sep 22	Oct 12	19	16.6	45
Inside Waters Vancouver Is.	1990	11 to 13	55	236,250	Jan 1	Jan 12	13	86.4	236
	1991	18 and 19	55	236,250	Jan 14	Jan 26	13	74	202
	1992	12 and 13	55	229,167	Jan 15	Jan 19	5	156	426
	1993	18 and 19	27.5	114,583	Feb 2	Feb 3	2	31	85
	1994	closed	0	0	-	-	-	-	-
	1995	12 and ptn. 13	27.5	-	Nov 15	Dec 3	17	28	76
	1996	18 & 19	27.5	-	Oct 7	Oct 21	14	27.3	75
	1997	ptn. 12 & 13	41.2	-	Sep 22	Oct 12	19	41.3	113
NORTH COAST									
Queen Charlotte Is.	1990	1,2E,2W	59	252,000	Jan 1	Feb 17	17	27.8	76
	1991	1,2E,2W	59	252,000	Jan 14	Feb 2	20	71	194
	1992	1,2E,2W	59	245,833	Jan 15	Jan 30	16	68	186
	1993	1,2E,2W	59	245,833	Feb 2	Feb 9	8	80	218
	1994	ptn. 2E	59	245,833	Nov 3	Nov 8	6	48.7	133
	1995	ptn. 2E	57.7	-	Nov 15	Dec 5	14	48	131
	1996	closed	0	0	-	-	-	-	-
	1997	closed	0	-	-	-	-	-	-
Prince Rupert District	1990	3,4,5	62	267,750	Jan 1	Jan 23	23	56.4	154
	1991	3,4,5	62	267,750	Jan 14	Jan 22	9	117	319
	1992	3,4,5	62	258,333	Jan 15	Jan 18	3.5	85	232
	1993	3,4,5	62	258,333	Feb 2	Feb 4	3	91	248
	1994	3 and 4	62	258,333	Nov 3	Nov 6	4	56.1	153
	1995	3 and ptn. 4	60.5	-	Nov 15	Dec 5	17	61.1	167
	1996	5 & 6	90.5	-	Oct 7	Oct 21	14	90.8	248
	1997	ptn. 5 & 6	87.8	-	Sep 22	Oct 12	19	85.6	234
Central Coast Areas	1990	6 to 10	62	267,750	Jan 1	Jan 8	8	81.3	222
	1991	6 to 10	62	267,750	Jan 14	Jan 17	4	132	360
	1992	6 to 10	62	258,333	Jan 15	Jan 16	2	105	287
	1993	6 to 10	62	258,333	Feb 2	Feb 3	2	91	248
	1994	ptn. 7	62	258,333	Nov 3	Nov 4	1	65.9	180
	1995	ptn. 7 and 8	60.5	-	Nov 15	Dec 5	20	63.9	174
	1996	ptn. 7	87.8	-	Oct 7	Oct 21	14	86.1	235
	1997	ptn. 7 & 8	87.8	-	Sep 22	Oct 12	19	87.8	240

Table 3.3.6. Annual sea cucumber split weight landings (tonnes) by South Coast Management Area, 1980 to 1997, as reported on fish slips and validation Logs.

	SOUTH COAST MANAGEMENT AREAS																		
	East Coast Vancouver Island											West Coast Vancouver Island						Annual Totals[2]	
Year	11	12	13	14	15	16	17	18	19	28	29	20	23	24	25	26	27	split	round
1980/81				3		<0.1	5	6	<0.1			2		<0.1	<0.1			16	44
1982						No landings recorded												0	0
1983			88	2		16	5	7	56				<0.1	<0.1	2	17		193	527
1984			1	2			22	5	11									41	112
1985		9	53	9		5	5	16	18		1			10				126	344
1986			16	31	14	31	66	67	59			1	2			1		288	786
1987		49	86	8	28	65	1	25	33	18		<0.1	13	50	62	33	4	475	1,297
1988	22	26	52	<0.1	6	5	1	83	31	<0.1		4	4	163	29	23	42	491	1,340
1989		22	48					16	10			19	14	52	11	1	11	204	557
1990		50	20			<0.1	2	12	2			3		49	11		4	153	418
1991								57	16						49		49	171	467
1992[1]		94	51										3	38				185	505
1993								21	10							12	29	72	195
1994													14	12				26	70
1995[3]		10	18											25				53	145
1996[3]								7	21							14	14	56	153
1997		25	17											17				59	161
Area Totals	22	285	450	55	48	122	107	322	267	18	1	29	49	416	164	101	153	2,608	7,121

Mainland and East Coast Vancouver Island:	1,696	West Coast Vancouver Island:	912
		South Coast Total:	2,608

[1] Corrected weights for Areas 12 and 13 from Heizer and Hobbs, PSARC Working Paper 194-21

[2] Landings through 1991 were reported in round weight. All figures have been converted to split weight by dividing round weight by 2.73.

[3] Preliminary data from validation Logs

Table 3.3.7. Annual sea cucumber split weight landings (tonnes) by North Coast Management Area, 1987 to 1997, as reportd on sales slips and validation logs.

	NORTH COAST MANAGEMENT AREAS												
												Annual Totals[2]	
Year	1	2E	2W	3	4	5	6	7	8	9	10	split	round
1987		7			1	2	2	138	5			155	423
1988		<0.1			7	<0.1	44	155	6			212	579
1989		43			27	53	26	63	3			215	587
1990		27	1	20	16	21	12	70				167	456
1991		71		14	22	82	25	106				319	870
1992		66	2	18		68	51	37	17			259	707
1993		67			6	75	79					227	620
1994[1]		49		48	8			66				171	467
1995[3]		48		51	10			5	59			173	472
1996[3]						17	74	86				177	483
1997						32	51	29	58			170	464
Area Totals	0	378	3	151	97	350	364	755	148	0	0	2,245	6,127

[1] 1994 data incomplete.

[2] Landings through 1991 were reported in round weight. All figures have been converted to split weight by dividing round weight by 2.73.

[3] Preliminary data from validation Logs.

Table 3.3.8. History of Management Actions in the Commercial Sea Cucumber Fishery

1971-76:	First reported commercial landings of sea cucumber.
Prior '82:	Sea cucumbers fished under the authority of a 'C' license.
1982:	Due to conservation concerns, the fishery was not opened in many areas. Scientific permits, with mandatory logbooks, were issued in South Coast areas; only 5t were landed.
1983:	Z-license introduced with logbook requirements; facilitated the monitoring of fishing activity and fishery potential.
1984:	P-licences issued; permitted vessels to process their own catch at sea.
1985:	In consultation with processing plants, a standard wet landed weight of 1.4 lb. (0.635 kg) per cucumber was established.
1985/86:	Through a paper submitted to PSARC, Sloan and Harbo (1987) considered that only a small proportion of the stock was being harvested. Monitoring showed that some sea cucumbers were left untouched in harvesting areas (DFO surveys 1981, 1983 & 1985). Recruitment was observed on spat collectors suspended in the water. Recommendations were: - arbitrary, precautionary quotas and fishery monitoring through logbooks; - research on juvenile growth rates and potential nursery areas. In June of 1986, the North Coast opened with a 500 t (round weight) arbitrary, precautionary quota.
1987:	Following PSARC review in 1986, the entire B.C. coast was opened with an arbitrary, precautionary quota of 500 t in each of three areas: North [PFM (Pacific Fishery Management) Areas 1-10], west coast of Vancouver Island (WCVI) (PFM areas 20-27), South Inside (PFM Areas 11-19, 28 & 29). Two vessels were given experimental licences to trawl for sea cucumber, but the sizes landed were small and the recovery of muscle strips was low. 1987 was also the first year that landing of North Coast product was reported. CPUE began to decline in the South Coast areas; fishermen reported increased search time. A recommendation was made to consider rotating areas, Washington State does.
1989:	Following the 1988 review, and apparent decline in CPUE, the South Coast quotas were reduced to 150 t round weight Inside and 150 t round weight WCVI. Three sub quotas were set for the North Coast, 160 t round for QCI and 170 t round for each of Prince Rupert and the Central Coast.
1990:	Up to six P licences processed product in the North.
1991:	Licence limitation (78 licences) and area licensing were introduced. The South Coast was split into two quota areas: the Inside Waters (150 t round) and the West Coast of Vancouver Island (150 t round). The North Coast was split into three quota areas: Prince Rupert (170 t round), the Central Coast (170 t round) and the Queen Charlotte Islands (160 t round).
1992:	84 licences (after appeals). Quotas were expressed as split weight for the first time, due to changes in the industry. A global conversion factor of 2.73 (split weight to round weight) was introduced based on plant sampling and the standardized plant weight of a round sea cucumber of 0.635 kg (1.4 lb.). South Coast Quota: 110 t (55 t Inside, 55 t WCVI). North Coast Quota: 183 t (62 t Central, 62 t Prince Rupert, 59 t QCI).
1993:	84 licences. A three year area rotation was introduced in the South Coast to allow for two years of "recovery". As a consequence, quotas were reduced in each of the south coast quota areas from 55 t (split) to 27.5 t. Area 7 was closed in the north in an attempt to direct fishing away from a heavily harvested location. Sport fishing for sea cucumber was closed coastwide until a bag limit was set in the Sportfish Regulations
1994:	85 licences. South Coast quota 27.5 t. There was no fishery in Inside Waters due to quota overages in 1992 in Areas 12 and 13. North Coast quotas were unaffected.

Table 3.3.8. History of Management Actions in the Commercial Sea Cucumber Fishery (con't)

1995:	August 1995, Individual Quotas (IQs) approved by DFO. Equal IQs for each of the 85 licences. This equates to 1/85th of the coastwide quota of 233 t split weight or 2.74 t. (6,049 lb.)/licence. South Coast retained 20 licences and the North Coast held 65 licences. A service bureau was contracted by Industry and all landings were validated. Validation and Harvest Logs were combined.
1996:	Four licencing areas opened. The licences from QCI were redistributed into the Central Coast and Prince Rupert. This was done as a small fishery of 6,049 lb./licence is barely economically viable from QCI. Options to increase economic viability for QCI are being discussed; industry funded population density surveys may justify quota increases. Sportfishing bag limit set at 12 per person per day with a two day maximum possession; open all year.
1997:	New Adaptive Management Strategy in place. Allows present quota of 233t split weight to be harvested in about 25% of the coastline. These areas will remain static. New areas, up to another 25% of the coastline may also open after industry has proven population density and a scientifically based harvest strategy has been developed. Details of the Adaptive Management Strategy are outlined in PSARC Working Paper I96-12.

4.0 CRUSTACEANS

4.1. Crab Trap Fisheries - I. Winther & A. Phillips

4.1.1 Introduction

Dungeness crabs (*Cancer magister*) are the most important species of crab harvested in British Columbia and are exploited by commercial, Native and sport fishers coast wide. Dungeness crabs occupy the eastern Pacific Ocean and range from the Aleutian Islands to Mexico, from the intertidal zone to depths of 180 m (Hart, 1982). The inception of the commercial fishery occurred before the turn of the century with first recorded landings in 1885 (Butler, 1984). Recent (1980 to 1997) commercial landings are presented in Tables 4.1.1., 4.1.2. and 4.1.3. (Figures 4.1.1. and 4.1.2.). The sport fishery has an equally long history. Aboriginal harvests of Dungeness crab precede the discovery of North America by Europeans. Natives claim crab harvests for food as part of their heritage and are guaranteed access to the resource in Canada's constitution.

Crab are most commonly harvested using traps or ring nets. They are occasionally collected from shallow waters by hand, using SCUBA, or dip nets. Sport and Native fishers may use any of these methods. Commercial fishers generally use traps or ring nets. Traps are frames covered with web to form an enclosure. Crabs gain access to the enclosure through a tunnel or door. The doors or tunnels may be triggered to form a one-way entrance. Ring nets are simply a circular frame holding a bag of web. Crab are captured in the web bag when they cross the edge of the frame and the frame is lifted. Traps and ring nets are baited with fish, squid, offal, or fish food pellets. Crabs enter the trap or ring net to feed on the bait or to investigate other crab activity. Ring nets are fished on single lines. Traps may be fished singly or on long lines with multiple traps.

4.1.2 Biological Objectives

Biological objectives for Dungeness crab fishery were developed as part of regional biological objectives for the Pacific Stock Assessment Review Committee (PSARC) of the Department of Fisheries and Oceans (Rice et. al. 1995). Biological objectives are to:

- Ensure that the population (or subpopulations) of Dungeness crabs along the B.C. coast do not become biologically threatened throughout their ecological range.
- Ensure the reproductive capacity of crab stocks is protected and maintained in the face of fishing activity.
- Ensure that a fishery for Dungeness crab does not violate the above two objectives for other ecologically related species.
- Ensure that habitat for both juvenile and adult crabs is not destroyed or alienated.

4.1.3 Fishery Management Actions

Natural fluctuations in Dungeness crab populations do not allow for a steady state or equilibrium harvest, consequently fisheries are not managed to a total allowable catch, nor is management of this sort anticipated (Butler, 1984). Conservation objectives are met through maintenance of the reproductive potential of crab stocks. Fundamental goals are to protect female crab and only harvest male crab after they have had the opportunity to breed. Size restrictions have been the primary management tool for Dungeness crab populations since 1906 when a 6 in. (153 mm) size limit was initiated. This limit was changed to 6.5 inches (165 mm) in the 1910's (Jamieson, 1984).

The 165 mm minimum size limit (measured across the maximum width of the carapace, commonly called "spine to spine") was designed to protect sexually mature male crabs for at least one year prior to harvest. Few females reach the size limit but were protected from the commercial fishery by a regulation from 1926 to 1957 that prohibited the retention of ovigerous females. This regulation was revoked as redundant with the size limit in 1957, however, it was reintroduced as a condition of licence in the commercial fishery prohibiting retention of all females in 1992.

Sport fishers have been required to have a British Columbia Tidal Sport Fishing licence to harvest shellfish since 1995. Aboriginals have been licensed to harvest crab under Communal Aboriginal Fishing Licences issued to Native bands since 1992. Native bands designate or issue licences to aboriginal harvesters.

Licensing of the commercial crab fishing fleet began in 1966 with the licensing of other commercial fisheries. All three of the initial salmon licence categories issued, A, B and N, were authorized to harvest crab. Subsequent licence categories C (General), G (Geoduck), K (Sablefish), L (Halibut), S (Shrimp Trawl) and T (Groundfish Trawl) also included the authority to harvest crab using traps for a maximum potential fleet of over 6000 vessels. Prior to 1990, annual landings had been made by as many as 386 vessels. An R category licence for crab was initiated by the Department in 1990 in response to high levels of fishing effort on crabs. The Department (DFO) limited the number of R licences to 223 in 1991. The licence eligibility criterion was 15,000 pounds cumulative landings over the three year period from 1987 to 1989. The number of eligible licences fluctuated slightly after licence limitation due to licence appeals (Table 4.1.4.). The R licence includes Dungeness crab, Red Rock crab (*Cancer productus*), Graceful crab (*Cancer gracilis*), Red King crab (*Paralithodes camtschatica*) and Golden King crab (*Lithodes aequispina*). Landings of Red King crab are presented in Table 4.1.5. Commercial landings of Red Rock crab, Graceful crab and Golden King crab have not been significant and do not appear in the British Columbia catch statistics.

Area licensing was implemented with the R license in 1990; crab fishers were required to choose one of six licence areas annually. Annual area selections were altered in 1992 when fishers could choose between five licence areas and all licensed fishers could fish the offshore area. These areas are described in Table 4.1.6. Two areas were divided in 1997 to form a total of 7 licence areas as described in Table 4.1.7. The distribution of licences by area for 1990 through 1997 is shown in Table 4.1.4. Representatives from Area A lobbied the Crab Sectoral Committee and DFO to extend the period that vessels were designated in an area. Beginning 1997, licence holders selected a licence area for a period of 3 years. Boundary Bay was separated from Fraser River on a one year trial basis in 1997 and the separation was entrenched for 1998 and 1999. Licence holders will be able to designate a new area for the 2000 season and will have the opportunity to provide advice on the duration of area selection.

Management actions for the crab fishery are detailed chronologically in Table 4.1.8.

Handling mortality of undersized, female, and soft shelled crab remains a concern in the fishery. All traps have been required to be fitted with an escape hole of 100 mm to allow undersize crabs to escape since 1990. Subsequent to the 1991 PSARC review of a proposed escape ring size increase from 100 mm to 110 mm, it was announced that the new ring size would become effective in 1992. There was continued concern on the part of the fishermen with regard to the loss of legal crab with the larger ring size. Public meetings were held early in 1992 to discuss the research and rationale for the ring size change. Due to delays in consolidation, the ring size change was delayed to 1994. In 1994, implementation of the 110 mm rings was again delayed in response to strong lobbying by the crab industry. The Department agreed to investigate the possibility of closures during soft shell periods as an alternative to larger escape holes, however, no agreement was reached between fishers and DFO on appropriate times for soft shell closures.

Fishers in Area B opted for 110 mm escape holes effective January 1, 1998 after a three year phase in period.

"Ghost fishing" is common to trap fisheries: Lost fishing gear continues to cause mortalities as crab enter the trap, die and bait the trap with their bodies, or are cannibalised by new entrants drawn to the activity of other crab in the trap. Destructive mechanisms have been incorporated to prevent traps lost in the fishery from continuing to fish. Rigid frame traps with hinged lids must be fitted with a biodegradable cord on the lid tie down. In 1997, the use of rot cords was limited to hinged lid traps with a volume less than 400 litres in response to large crab traps with unsecured lids that remained closed due to their weight. The weight of the cord required was varied from #36 in 1990, to #54 in 1991 and to #120 in 1992 to reduce premature rotting. Traps without hinged lids must be fitted with a square panel, 11 cm per side, laced in with biodegradable cord (called a "rot panel"). The panel size was varied from 20 cm per side to 11 cm per side in 1993. Rot panel size was varied in Areas A and B in 1997 to 35 cm by 35 cm or a "V" measuring 50 cm on each leg to protect king crab. Biodegradable escape mechanisms were incorporated in the sport fish regulations in 1996. The majority of Aboriginal licences were issued with conditions requiring destructive devices in 1995.

A trap limit of 125 traps per licence was implemented for the Tofino fishery in 1991 and a 300 trap limit was initiated in the Fraser River in 1995. Trap limits were initiated to reduce problems of congestion on the fishing grounds. Trap limits have been suggested in a number of other areas but haven't been approved by industry.

Single trap gear was required in Boundary Bay in 1997 to alleviate problems of fishers setting gear over one another. A single trap gear restriction effective January 1, 2000 for Area A was advanced to May 1, 1998 in response to illegal activity during the soft shell closure in 1997. A minimum size was set for crab buoys in 1997 due to continued complaints regarding the navigational hazards of gear marked with small (gillnet) floats.

The Fraser River area has had an annual soft shell closure since 1983. The timing of the closure varied prior to 1990 but was from January to mid-July from 1990 to 1996. Managers and charter operators monitor openings to ensure that crab are hard enough. Openings were tailored to each area when Boundary Bay was separated from the Fraser River area in 1997 (Table 4.1.8.). Fishers had experienced a later soft shell period in Boundary Bay.

Significant incidences of soft crab have been experienced annually in Hecate Strait since 1993. Fishers attempted several "gentlemen's agreements" in 1994 and 1995 to move gear away from areas of soft crab or to leave gear open and unbaited during these periods. These attempts could not be enforced by DFO and failed due to lack of co-operation from the fleet. A closure of all of Area A was initiated in 1996 for the period of June 1 to July 15. DFO recovered 380 illegal traps during the closure and it became evident that DFO vessels were poorly equipped to deal with gear recovery in Hecate Strait and Dixon Entrance. Fishers agreed to fund a monitoring program through crab caught in a test fishery in 1997. Two vessels were chartered to monitor soft crab during the closure and recover illegal gear. Fishers opted to extend the closure to July 31 when it was evident that the majority of crab weren't hard enough for the market. The charter vessels recovered over 1300 illegal crab traps. Charter captains estimated that they recovered about a third of the illegal gear. Most of the illegal traps were on long lines and were baited heavily to fish through the closure.

There are numerous closures to the commercial fishery as allocations to Aboriginal and recreational fisheries (Table 4.1.8.). These closures are in two forms; seasonal closures for a portion of the year where Native and recreational fishers are provided first access to crab, and permanent closures for the entire year where Native and sport fishers have the only access to the crab. Most of these closures are in Area B.

As benthic scavengers, crabs may accumulate toxins, either naturally occurring or introduced. Area 27 was closed in 1993 and Areas 1, 101, 102, 104 and 105 were closed September 7, 1995 due to domoic acid contamination. In 1995, fishers quickly provided samples from the area that resulted in most of the area being reopened, however Subarea 101-10 remained closed until January 1996. Many areas have been closed to crab fishing due to contamination by dioxins and furans, primarily from pulp mills (Table 4.1.9.). Increased control on the release of contaminants by industry has reduced the number of closures in recent years.

The removal of the contamination closure from Cowichan Bay created an allocation problem for managers. Sport and Native fishers, subject only to a hepatopancreas consumption advisory prior to 1995, were against the reintroduction of commercial fishing in the area. The area was finally designated closed to commercial fishing for Native and Sport access after lengthy consultations. This issue highlighted the need for policy on the allocation of crab resources. Several proposals are received annually from native and sport groups to designate areas non-commercial. A portion of Port Renfrew was closed to commercial fishing in 1998. Work is in progress by a subcommittee of the Shellfish Working Group on allocation policy for shellfish with the objective of a consistent approach to closure requests.

The activity of moving gear and crab to and from the grounds was limited to the licensed vessel in 1996. This restriction was implemented when fishers planned to fish Area A using mother ships and barges to facilitate operations from small catcher vessels. Managers wanted to maximise the effort limitation inherent in vessel length restrictions and fishers wanted to protect their investments in boats and licenses. The condition was modified in 1997 to allow fishers in Fraser River and Boundary Bay to use barges on opening day only. The trap limit in the Fraser River area and the dangerous conditions in the river were cited in this allowance.

Theft of crab traps and catch was a significant problem in Area A. A condition to mark all traps with the vessel registration number was implemented in 1998 in Area A to assist Fisheries Officers and the RCMP with enforcement.

The use of "ribbon boundaries" was challenged in court so closures were changed in 1997 to incorporate point to point or latitude/longitude descriptions. Officers have had particular problems with the Kinkolith Native and Sport Access closure.

Crab fishers were permitted to haul crab gear only between 1 hour before sunrise and 1 hour after sunset in the Fraser River area beginning in 1994. The same condition was implemented in Johnstone Strait and the Strait of Georgia in 1998. This assists enforcement by limiting crab fishing activity to daytime hours.

4.1.4 Catch and Effort

Landings of Dungeness crab coast wide have declined since 1993 (Table 4.1.1.). Coast wide trends have been driven by the Area A fishery which peaked in 1993 at 4798 tonnes (Table 4.1.2.). Landings in the Fraser River (Area D) returned to average in 1997 after a peak in 1995. Landings in Area B in 1997 declined to half of the recent average. Effort has declined significantly in Area B but fishers report that abundance is also down.

The total value of the Dungeness crab fishery peaked in 1994 at $25.6 M but indications are that 1997 could exceed this maximum. (Fish slip data exceeded $25.3 M on January 12, 1998 and is still being submitted.) The average annual value of Dungeness crab jumped to a record $7.44 kg^{-1} in response to poor fisheries in Washington and Oregon in 1997. Prices were near $8.80 kg^{-1} early in 1997 and in January 1998. Fishers may want to alter the timing of some short fisheries if the trend to higher prices in the winter continues.

There have been consistent increases in vessels electing to fish Area A since 1991 in response to increased crab abundance. The number of vessels electing the West Coast, Area E, and the North Coast, Area B, have declined (Table 4.1.4.). Numbers of vessels operating east of Vancouver Island and in the Fraser delta have remained relatively static.

Effort in vessel days increased to 1996 then declines in 1997 (Table 4.1.1.). 1997 data is preliminary but declines could be the result of the extended soft shell closure and poor weather conditions in Area A. A number of vessels that recently selected Area A (and are now tied in until 2000) have found the area difficult to fish using small vessels because of the extreme conditions.

Effort in vessel days doesn't consider increases in effort due to larger trap inventories or other changes to fishing power. For example, the amount of gear in Area A continues to increase. A ballot of Area A fishers in 1997 estimated the inventory at 50,000 traps. The level of effort appears too high, especially considering declines in abundance. Fishers report that trap inventories in areas of the coast without limits could increase since cheap traps ($85) have become available from China. Trap loss appears to be 10 to 15 percent annually.

4.1.5 Stock Assessment Activities

A tagging study designed to estimate the magnitude of mortalities due to fishing activities was concluded in the Fraser River delta in 1997. Two cruises to the Fraser delta were conducted in 1997 as pre-fishery and post-fishery stock surveys to provide indices of abundance, population structure and moult timing.

Stock assessment staff and managers participated in charter test fisheries of Hecate Strait and McIntyre Bay to determine moult timing and population structure for stocks in Area A.

A September trawl survey for juvenile crabs was conducted in McIntyre bay, Masset Inlet and Hecate Strait in 1997. Adult crab stock information was collected using research crab traps. The survey compliments a similar survey conducted in September 1994, which was designed to define juvenile distribution and habitat usage in a period of high adult stock abundance.

4.1.6 Enforcement Concerns

Conservation in the crab fishery is assured by the size limit, the commercial sex restriction, seasonal and area closures, escape mechanisms (escape holes and rot chords or panels), and catch monitoring. Thus the most serious offences threatening conservation are retention of undersized crab, commercial retention of female crab, fishing in closed areas, not using escape mechanisms and improper reporting of catch. Crab fishers have recommended licence sanctions for serious offences.

Retention of undersized crab is more prevalent in Areas B and D. Intensive fisheries in these areas quickly harvest most legal sized crab early in the season. The retention of undersized crab by the sport fleet is more prevalent in Area D. This practice is not as common by the sport fleet in Area B since the area has the greatest amount of crab habitat allocated to sport and native fisheries on the coast.

Poaching in closed areas represents a serious problem. Officers recovered over 1300 traps from Area A during the soft shell closures with the use of charter vessels. Charter vessels provided platforms for enforcement activities in Area A because the availability of DFO vessels was limited and commercial vessels are better suited to hauling large quantities of crab gear.

Failure to report catch and fraudulent reports of catch are chronic in the crab fishery. A "point of landing" requirement for fish slips was suggested by the Shellfish Working Group in 1994 but was tied up with national requirements. Third party validation of crab landings was considered in 1996

for North Coast Areas A and B but there was little support from crab fishers. Submission of fish slips and harvest logs remains difficult to enforce. Currently, reporting infractions are offences under conditions of licence that must be settled in court. Officers have suggested a system of voluntary penalty tickets as an option to reduce the amount court time. This option hasn't been exercised since it would require all conditions to be set out in regulation; a lengthy process that isn't as flexible as conditions of licence.

The lack of integration of information between the sectors within DFO (Conservation and Protection, Fisheries Management, Licensing, Statistics, and Science) makes it difficult to identify and investigate illegal activity. Officers need efficient access to information that allows the correlation of fishing activity observed with harvest logs and fish slips. This issue was highlighted as a high priority PSARC recommendation in 1994. There have been improvements in the area of data sharing but information has not been integrated.

Incidents of neglect and abandonment of gear are increasing as trap inventories increase. The current regulation that gear must be checked every 14 days is difficult to enforce.

Vessels and manpower available to enforce the crab fishery are limited. The crab fishery occurs over a very large geographic area. The current management practice of concurrent openings over most of the coast makes enforcement actions unlikely in much of the region.

4.1.7 Crab Sectoral Committee and Industry

The Crab Sectoral Committee deals with regional issues in the crab fishery. One commercial fishery representative elected from each management area holds a seat on the committee. Non elected representatives include processors, a provincial representative and DFO personnel. Seats exist for special presentations by Sport and Native representatives. The Sectoral Committee meets annually to review draft management plans for the coming year. Fishers re-elected representatives to the Crab Sectoral Committee in 1997. Representatives sit on the committee for a 2 year term.

Many issues in this fishery are Area specific, consequently, much of the consultative process occurs within Area Committees. Area Committees are made up primarily of licence holders but may be made up of elected members (e.g. the Fraser River). Buyers, shippers and processors are welcome to the Area Committee meetings to express their views. Area committees meet once or twice annually to deal with issues specific to the area and to identify issues for the Sectoral Committee.

4.1.8 Priority Issues

Illegal harvests during closed times continue in the crab fishery. Enforcement presence on the grounds is down due to fleet reductions and amalgamation with Canada Coast Guard. Remaining vessels are poorly equipped to handle large amounts of commercial crab gear. Use of chartered commercial vessels has been effective in some instances.

Harvests of undersized crab remain a serious threat to conservation. Such activity could become more prevalent during periods of lower abundance.

Lack of catch reporting and fraudulent reporting continue to plague all analyses of the crab fishery. Integration of information and efficient methods of investigation (computing) are required to allow officers to identify offences in fish slip and harvest log submissions. Efficient ways of dealing with infractions out of court would streamline the process and could become a source of revenue for further enforcement activities.

Catch is the only index of abundance for all areas other than the Fraser River. The development of fishery independent indices might be appropriate given the problems with catch reporting. Collections of biological data from the fishery and fishery independent sources are infrequent or non-existent outside of the Fraser River area.

Introduction of the European Green crab (Carcinus maenas) could represent a threat to local crab stocks. Implications of the introduction are speculative and it is unlikely that an invasion could be stopped even if it was destructive to existing populations.

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Table 4.1.1. Annual catch and effort for commercial dungeness crab fishery, 1980-1997.

Year	No. of Licences	Catch (tonnes)	Effort (landing days)	CPUE (tonne/day)	Value ($'000)	Price ($/kg)
1980	343	1,701.0	13,369	0.13	N/A	N/A
1981	366	1,314.5	12,336	0.11	N/A	N/A
1982	352	998.5	12,097	0.08	N/A	N/A
1983	369	957.0	12,987	0.07	3,319.8	3.47
1984	387	1,155.6	15,731	0.07	4,557.7	3.94
1985	362	1,164.1	16,841	0.07	4,719.2	4.05
1986	386	1,319.5	19,559	0.07	5,660.9	4.29
1987	363	1,630.6	19,828	0.08	6,451.6	3.96
1988	331	1,507.9	16,214	0.09	5,945.8	3.94
1989	330	1,518.5	17,738	0.09	6,028.4	3.97
1990	497	2,129.4	19,929	0.11	8,919.1	4.19
1991	223	1,857.8	17,747	0.10	8,340.8	4.49
1992	224	3,333.6	18,283	0.18	11,008.0	3.30
1993	224	6,289.2	17,450	0.36	18,607.1	2.96
1994	223	5,995.3	20,568	0.29	25,622.0	4.27
1995	223	4,539.2	20,919	0.22	23,183.8	5.11
1996	221	4,930.7	24,683	0.20	23,240.0	4.71
1997	220	3,082.6	19,383	0.16	22,919.1	7.44

Source: BC Catch Statistics updated December 18, 1997.

1997 data is preliminary. Landings were up to 3400 tonnes valued at $25.3 M on January 12, 1998. Additional landings are expected.

Table 4.1.2. Dungeness crab landings (tonnes) by licence area, 1990 to 1997.

Year	Area A (QCI)	Area B (NCCM)	Area C (GSJS)	Area D (FR)	Area E (WCVI)	Total
1980	901.0	107.0	215.0	252.0	226.0	1,701.0
1981	548.4	126.3	171.7	229.5	238.6	1,314.5
1982	257.3	78.8	127.4	260.5	274.5	998.5
1983	141.6	160.9	141.6	274.0	238.9	957.0
1984	152.3	141.8	277.5	340.9	243.1	1,155.6
1985	166.3	107.6	180.8	352.5	356.9	1,164.1
1986	219.0	98.9	261.0	321.2	419.4	1,319.5
1987	257.6	135.4	230.1	424.3	583.2	1,630.6
1988	378.6	139.6	225.3	456.3	308.1	1,507.9
1989	351.5	237.3	227.6	407.9	294.2	1,518.5
1990	777.7	275.2	314.6	414.6	347.3	2,129.4
1991	447.9	434.8	305.2	314.9	355.0	1,857.8
1992	1,600.3	418.5	362.0	447.1	505.8	3,333.6
1993	4,798.0	282.2	419.1	491.1	298.8	6,289.2
1994	4,272.5	354.8	537.2	445.9	384.9	5,995.3
1995	2,728.8	474.1	434.1	645.4	256.8	4,539.2
1996	3,320.8	369.4	569.0	400.6	270.9	4,930.7
1997	1,568.1	176.2	495.4	428.0	414.9	3,082.6
Average						
1980-89	337.4	133.4	205.8	331.9	318.3	1,326.7
1990-97	2,439.3	348.1	429.6	448.4	354.3	4,019.7

Notes:

Prior to '88 the data includes all species of crab.

Prior to '90 landings are reported by management areas (MA) from catch statistic with the following break down, Area A = MA 1 & 2, Area B = MA 3 to 10 inclusive, Area C = MA 11 to 19 inclusive, Area D = MA 28 & 29, Area E = MA 11 to 19 inclusive.

The offshore catch of 7.6 tonnes in 1990 was included in Area E.

Landings after Area selection in 1990 are reported by area selected, not by MA reported on the fish slips due to reporting errors. See Table 7 for Area descriptions.

License limitation was implemented in 1991.

Table 4.1.3. Commercial dungeness crab landings (tonnes) by Area, 1980-1997.

AREA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	TOTAL
1980	773	128	14	59	24	8	1	1	1	1	1	54	2	1	1	2	27	35	93	53	22	2	1	130	9	6	3	19	233	1701
1981	488	61	14	100	7	6	0	0	0	0	0	29	1	0	0	11	15	40	75	35	2	5	4	175	10	5	3	15	215	1315
1982	237	20	2	75	1	1	0	0	0	0	0	28	1	3	0	1	22	23	50	93	2	2	3	157	6	7	4	10	251	999
1983	136	6	7	149	3	2	0	0	0	0	2	39	9	1	0	0	39	29	22	57	6	1	25	136	7	3	3	21	253	957
1984	146	6	22	106	2	2	7	0	4	0	0	74	20	1	2	0	55	53	74	81	1	12	30	110	2	3	5	46	295	1156
1985	160	6	34	65	1	4	2	0	0	1	1	42	3	2	4	1	50	20	60	156	2	5	32	152	4	1	5	27	326	1164
1986	206	14	18	58	11	6	5	1	0	0	0	54	26	5	1	4	31	43	98	113	4	2	21	265	6	3	6	24	297	1320
1987	246	12	9	104	4	11	1	2	1	3	1	72	3	0	1	5	21	38	89	93	0	8	9	449	10	3	11	4	421	1631
1988	352	26	53	76	0	7	1	0	1	1	20	77	3	1	3	1	40	31	50	41	1	8	6	227	6	2	17	6	450	1508
1989	343	8	2	198	7	15	4	2	1	9	2	44	10	2	2	7	36	52	74	33	9	7	23	203	12	2	6	6	402	1518
1990	667	82	11	268	10	11	2	0	0	4	2	115	10	0	0	4	28	25	117	74	9	5	5	223	22	7	14	41	375	2129
1991	414	30	7	388	26	2	1	0	0	3	1	131	3	0	2	1	36	30	107	76	14	3	0	222	13	4	25	56	265	1858
1992	1071	461	1	406	54	20	2	2	0	3	0	144	16	0	0	2	56	40	110	125	23	6	3	300	20	1	24	41	402	3334
1993	1622	3020	53	200	166	16	0	0	0	0	1	138	8	0	0	5	53	57	148	57	1	7	1	181	18	3	29	33	469	6289
1994	1315	2772	110	298	100	37	7	0	0	0	2	112	9	0	0	3	98	110	214	114	7	8	1	182	15	4	57	62	357	5995
1995	1411	1132	203	342	59	32	0	3	4	10	2	128	5	0	0	3	56	86	156	44	11	1	2	158	15	5	24	29	616	4539
1996	1738	881	132	734	172	9	0	0	0	13	12	136	6	0	0	2	59	146	220	92	3	2	2	139	3	4	25	75	326	4931
1997	1076	249	50	306	66	1	0	0	1	1	0	115	4	1	0	1	52	101	224	226	4	1	1	166	1	1	11	67	357	3083
Average																														
1980-89	309	29	17	99	6	6	2	1	1	2	3	51	8	1	1	3	34	36	68	76	5	5	15	200	7	3	6	18	314	1327
1990-97	1164	1078	71	368	82	16	1	1	1	4	3	127	7	0	0	3	55	74	162	101	9	4	2	196	13	4	26	51	396	4020

Data from B.C. Catch Statistics updated December 1997. 1997 data preliminary.

Table 4.1.4. Crab "R" Licences Issued, 1990-1997.

LICENCE AREA	1990	1991	1992	1993	1994	1995	1996	1997
A. Queen Charlotte Islands	29	18	19	25	34	41	50	53
B. North & Central Coast Mainland	83	38	40	38	35	35	28	20
C. Johnstone & Georgia Straits	161	54	53	55	52	59	57	(56)
D. Fraser River	100	48	42	43	48	42	49	(47)
E. West Coast of Vancouver Island	121	65	70	63	54	46	37	44
F. Offshore	3							
Total	497	223	224	224	223	223	221	220

LICENCE AREA	1997
A. Queen Charlotte Islands	53
B. North & Central Coast Mainland	20
E. West Coast of Vancouver Island	44
G. Johnstone Strait	15
H. Strait of Georgia	41
I. Fraser River	31
J. Boundary Bay	16
Total	220

Notes:

1. Licence limitation was implemented in 1991.
2. The number of licences fluctuated between 1991 and 1994 due to appeals in the license limitation process.
3. Reductions after 1994 were due to licence retirements.
4. Licence Area C was split into Areas G and H in 1997.
5. Licence Area D was split into Areas I and J in 1997.

Table 4.1.5. King crab landings (kg) by Area, 1988-1997.

	Catch by Statistical Area							Total	Effort	Value
Year	1	2	3	4	5	6	26	Catch (kg)	(days)	($)
1988	0	16	2,397	656	0	0	0	3,069	116	48,837
1989	650	0	0	151	0	0	1,308	1,459	5	38,024
1990	0	0	33,605	904	0	0	0	34,509	83	374,404
1991	0	0	20,621	1,872	73	0	0	22,566	360	317,156
1992	0	0	10,772	2,732	512	1,291	0	15,308	298	180,774
1993	0	0	6,183	0	21,741	3,125	0	31,049	172	146,836
1994	4,876	0	2,029	0	2,138	0	0	9,043	77	60,124
1995	1,215	0	998	2,907	8,690	256	0	14,066	206	103,190
1996	0	3,867	7,197	772	420	0	0	12,256	342	167,295
1997	0	0	3,656	195	3	3	0	3,857	183	69,950

Data source- B.C. Catch Statistics

Table 4.1.6. Management area descriptions 1930-1996.

Area	Description	Areas as described in the Pacific Fishery Management Area Regulations
A	Queen Charlotte Islands (QCI)	Areas 1, 2, and Subareas 101-7, 101-10, 102-1, 104-1 to 104-5 inclusive and 105-1
B	North Coast & Central Coast Mainland (NCCM)	Areas 3 to 10 inclusive
C	Georgia Strait and Johnstone Strait (GSJS)	Areas 11 to 19 inclusive and Subarea 29-5
D	Fraser River (FR)	Areas 28 and 29 excluding Subarea 29-5
E	West Coast Vancouver Island (WCVI)	Areas 20 to 27, and Subareas 121-1, 121-2, 124-1 and 124-3
	Offshore	Areas 103, 106 to 111 inclusive, 123, 125 to 127 inclusive, 130 and 142 and Subareas 101-1 to 101-6 inclusive, 101-8, 101-9, 102-2, 102-3, 105-2, 121-3, 124-2 and 124-4

Table 4.1.7. Management area descriptions 1997.

Area	Description	Areas as described in the Pacific Fishery Management Area Regulations
A	Queen Charlotte Islands	Areas 1, 2, and Subareas 101-7, 101-10, 102-1, 104-1 to 104-5 inclusive and 105-1
B	North Coast & Central Coast Mainland	Areas 3 to 10 inclusive
E	West Coast Vancouver Island	Areas 20 to 27, and Subareas 121-1, 121-2, 124-1 and 124-3
G	Strait of Georgia	Areas 11, 12, 13, and 15
H	Johnstone Strait	Areas 14, 16 to 19 inclusive and Subarea 29-5
I	Fraser River	Areas 28 and 29 excluding Subareas 29-5 and 29-8
J	Boundary Bay	Subarea 29-8
	Offshore	Areas 103, 106 to 111 inclusive, 123, 125 to 127 inclusive, 130 and 142 and Subareas 101-1 to 101-6 inclusive, 101-8, 101-9, 102-2, 102-3, 105-2, 121-3, 124-2 and 124-4

Table 4.1.8. Management actions in the Dungeness Crab fishery.

Year	Areas or Subareas	Management action	Area	MA	In Effect	Year
1885	All	First record of commercial fishing.	All	0	Y	1885
1905-7	All	6.0 inch (153 mm) size limit.	All	0	N	1906
1914-26	All	6.5 inch (165 mm) size limit initiated between 1914 and 1926.	All	0	Y	1914
1926	All	Fishers prohibited from retaining soft shelled crab.	All	0	N	1926
1926	All	Fishers prohibited from retaining ovigerous female crab.	All	0	N	1926
1954	1-4	Naden Harbour closed May to September for soft shell.	A	1.4	A	1954
1954	1-4	Ring net gear only in Naden Harbour.	A	1.4	Y	1954
1957	All	Soft shell prohibition revoked due to the lack of a practicable criterion for shell hardness.	All	0	Y	1957
1957	All	Ovigerous female crab prohibition revoked due to redundancy for the protection of females, ovigerous or not, that rarely exceed the size limit.	All	0	Y	1957
1958	1-5	McIntyre Bay soft shell closure July 10 to September 20.	A	1.5	A	1958
1964	All	Territorial Sea and Fishing Zones Act declared waters within three miles of the coast Canada's Territorial Sea and waters between 3 miles and 12 miles of the coast Canada's Fishing Zone.	All	0	A	1964
1966	All	Crab first licenced under licence categories A, B, and N, followed by categories C, G, K, L, S and T.	All	0	N	1966
1978	All	Regulation requiring fishers to haul traps within fourteen consecutive fishing days.	All	0	Y	1978
1978	All	Canada's fishing zone extended to 200 miles off shore.	All	0	Y	1978
1980's	3-18	Iceberg Bay closed all year for Native Access.	B	3.1	A	1980
1980's	4-10, 4-11	Prince Rupert, Morse Basin closed for Sport and Native Access.	B	4.1	Y	1980
1980's	6-1	Kitimat Arm closed to commercial fishing for Native and Sport Access.	B	6.1	Y	1980
1980's	6-3, 6-4, 6-23	Ursula Channel, Gardner Canal and Khutze Inlet closed to commercial fishing August 1 to October 1 for Native and Sport Access.	B	6.3	A	1980
1980's	12-19	Nimpkish River estuary closed to commercial fishing for Native and Sport Access.	C	12	Y	1980
1980's	16-4	Pender Harbour closed to commercial fishing for Sport Access.	C	16	Y	1980
1980's	18-10	Fulford Harbour closed to commercial fishing for Sport Access.	C	18	Y	1980
1980's	23-1	Port Alberni closed to commercial fishing for Sport Access.	E	23	Y	1980
1980's	28-8, 28-10	False Creek and Burrard Inlet closed to commercial fishing for navigation purposes.	D	28	Y	1980
1983	All	Regulation requiring crab traps be marked by surface buoys with the vessel registration number	All	0	Y	1983
1983	All	Crab gear limited to traps, dip nets and ring nets. (No sharp implements.)	All	0	Y	1983
1983	28, 29	Fraser River soft shell closure imposed. (timing varied)	D	28	A	1983
1985	29-3, 29-4, 29-6, 29-7, 29-9, 29-10	Crab traps fished in the area of Roberts Bank need not be marked with floating buoys during salmon net seasons.	I	29	Y	1985
1987	Areas 3 to 6	Prince Rupert District soft shell closure May 10 to June 15.	B	3	N	1987
1987	24-4, 24-6, 24-8, 24-9, 24-11	Tofino soft shell closure May 7 to June 30.	E	24	N	1987
1987	28, 29	Fraser River area closed to commercial fishing March 16 to June 30 for soft shell.	D	28	A	1987
1988	All	Permits first issued to fish tanner crab.	All	0	N	1988
1988	Areas 3 to 6	Prince Rupert District closed May 7 to June 15, 1988 for soft shell.	B	3	N	1988
1988	Area C	Gulf (Area C) closed March 15 to July 1 for soft shell.	C	11	N	1988
1989	1-5	McIntyre Bay soft shell closure July 10 to September 14, 1989.	A	1.5	A	1989
1989	2-1 to 2-4, 2-50 to 2-52, 2-63 to 2-67, 2-77, 2-80 to 2-84, and 2-93 to 2-100	Portions of the Queen Charlotte Islands closed for Native and Sport Access.	A	2	A	1989
1989	Areas 3 to 6	Areas 3 to 6 closed January 1 to June 1, 1989 for soft shell.	B	3	N	1989

1989	6-2	Douglas Channel closed to commercial fishing from April 30 to October 1 for Native and Sport Access	B	6.2	A	1989
1989	7-6, 7-10, 7-11, 7-13 to 7-17	Areas in the vicinity of Klemtu and Bella Bella closed to commercial fishing August 15 to October 1, 1989 for Native and Sport Access.	B	7	A	1989
1989	8-3, 8-13	Koeye River and Lower Burke Channel closed to commercial fishing for Native and Sport Access.	B	8.3	Y	1989
1989	9-2, 9-3, 9-4, 9-10	Draney Inlet and portion of Rivers Inlet closed to commercial fishing for Native and Sport Access.	B	9	A	1989
1989	19-6	Sidney Spit closed to commercial fishing for Native and Sport Access	C	19	Y	1989
1989	24-4, 24-6, 24-8, 24-9, 24-11	Tofino soft shell closure March 1 to June 25, 1989.	E	24	N	1989
1989	28, 29	Fraser River area closed to commercial fishing March 1 to June 30 for soft shell.	D	28	A	1989
1990	All	Crab "R" category vessel based licence initiated.	All	0	Y	1990
1990	All	Harvest logs required in the commercial fishery.	All	0	Y	1990
1990	All	Annual area licencing initiated with 6 areas: A, B, C, D, E, & F.	All	0	A	1990
1990	All	100 mm escape holed required in crab traps.	All	0	Y	1990
1990	All	Rot cords or rot panels of #36 cotton twine required on all traps. Rot panels to exceed 20 cm by 20 cm.	All	0	A	1990
1990	All	All buoy lines required to be non floating.	All	0	Y	1990
1990	1-4	Naden Harbour closed May 1 to September 30 for soft shell.	A	1.4	Y	1990
1990	Ptn 1-5, 101-7, 101-10	McIntyre Bay closed from July 1 to September 21 for soft shell. Masset bar (1-5 west of Skonum Pt.) removed from the closure and 101-7 and 101-10 added to the closure.	A	1.5	Y	1990
1990	Subareas 2-50 to 2-52, 2-80 to 2-84 and 2-93 to 2-100	Portions of the Queen Charlotte Islands removed from the commercial closure for Native and Sport Access.	A	2	Y	1990
1990	Area B	Area B closed January 1 to May 31, 1990 to protect soft shell crab.	B	3	N	1990
1990	Ptn 3-12	Kinkolith half mile ribbon boundary between Nass Pt and Fort Pt closed all year for Native and Sport Access.	B	3.12	A	1990
1990	Ptn 3-12, 3-18	Nass River estuary (3-12 north of Arrandale and south of Nass Pt.) and Iceberg Bay closed January 1 to August 31 and October 1 to December 31 for Native and Sport Access.	B	3.12	A	1990
1990	6-2, 6-3, 6-4, 6-23	Douglas Channel, Ursula Channel, Gardner Canal and Khutze Inlet closed to commercial fishing January 1 to September 30 for soft shell and Native and Sport Access.	B	6.2	A	1990
1990	7-6, 7-10, 7-11, 7-13 to 7-17	Areas in the vicinity of Klemtu and Bella Bella closed to commercial fishing January 1 to September 30, annually, for Native and Sport Access.	B	7	A	1990
1990	8-7	Portion of Dean Channel closed to commercial fishing for Native and Sport Access.	B	8.7	Y	1990
1990	9-2, 9-3, 9-4, 9-10	Draney Inlet and portion of Rivers Inlet closed to commercial fishing from January 1 to September 30 for Native and Sport Access.	B	9	A	1990
1990	20-2	Port San Juan closed to commercial fishing July 1 to August 31 for Sport Access.	E	20	N	1990
1990	24-4, 24-6, 24-8, 24-9, 24-11	125 trap limit in Tofino area.	E	24	Y	1990
1990	Area D	Fraser River area closed to commercial fishing January 1 to June 30 for soft shell.	D	28	A	1990
1991	All	Licence limitation to 223 vessels.	All	0	Y	1991
1991	All	Weight of rot cord increased from #36 to #54.	All	0	A	1991
1991	All	Standard Buoy marking required.	All	0	Y	1991
1991	All	Non retention of female crab in the commercial fishery.	All	0	Y	1991
1991	Ptn 3-12, 3-18	Nass River estuary (3-12 north of Arrandale and south of Nass Pt.) and Iceberg Bay closed January 1 to September 30 for Native and Sport Access.	B	3.12	A	1991
1991	Ptn 19-5	Saanichton Bay closed to commercial fishing for Native and Sport Access	C	19	Y	1991
1991	24-4, 24-6, 24-8, 24-9, 24-11	Single trap gear and buoy color registration required in Tofino area for 125 trap limit.	E	24	Y	1991
1991	Area D	Fraser River area closed to commercial fishing January 1 to July 13 for soft shell.	D	28	A	1991
1992	All	Buoys used for marking crab gear must remain floating and be adequately visible to pose no navigational hazard.	All	0	Y	1992

1992	All	Aboriginal harvesters required to be licenced or designated under Communal Aboriginal Fishing Licences issued to Native bands.	All	0	Y	1992
1992	All	Area licencing altered to 5 areas with all vessels allowed to fish the offshore area: Area F.	All	0	A	1992
1992	All	Weight of rot cord increased from #54 to #120 to reduce premature rotting.	All	0	Y	1992
1992	4-8	Big Bay closed seasonally for Native Access, January 1 to September 30.	B	4.8	Y	1992
1992	Ptn 4-9	Duncan Bay closed seasonally for Native Access, January 1 to September 30. (Portion of 4-9 inside Ryan Pt. and Chapman Pt.)	B	4.9	Y	1992
1992	Ptn 4-9	Metlakatla Area closed for Native and Sport Access. (Portion of 4-9 inside Observatory Pt. and Doolan Pt.)	B	4.9	Y	1992
1992	5-3, 5-10	Kitkatla village area closed to commercial fishing for Native Access.	B	5.3	Y	1992
1992	6-2	Douglas Channel closed to commercial fishing all year for Native and Sport Access	B	6.2	A	1992
1992	6-3, 6-4	Ursula Channel and Gardner Canal closed to commercial fishing January 1 to September 8 for Native and Sport Access. September 8 selected to ensure Sport Access during the long weekend.	B	6.3	A	1992
1992	7-11	Kynock Inlet closed all year for Native and Sport Access.	B	7	A	1992
1992	7-6, 7-10, 7-13 to 7-17	Areas in the vicinity of Klemtu and Bella Bella closed to commercial fishing January 1 to September 30, annually, for Native and Sport Access.	B	7	A	1992
1992	Area D	Fraser River area closed to commercial fishing January 1 to July 16, 1992 and 1993 for soft shell.	D	28	A	1992
1993	All	Rot panel size reduced from 20 cm by 20 cm to 11 cm by 11 cm.	All	0	A	1993
1993	All	Issuance of tanner crab permits suspended by moratorium on new shellfish licences. (1992 was the last year with tanner crab permits.)	All	0	N	1993
1993	6-2	Coghlan Anchorage, Kitkiata Inlet and Kishkosh Inlet closed to commercial fishing for Native and Sport Access. Remainder of Douglas Channel opened.	B	6.2	Y	1993
1993	9-2, 9-3, 9-4, 9-6	Portions of Rivers Inlet closed to commercial fishing January 1 to September 30 for Native and Sport Access.	B	9	Y	1993
1993	Area 27	Area 27 closed due to domoic acid contamination.	E	27	N	1993
1994	All	Logbooks must be completed by midnight for the days fishing activity.	All	0	Y	1994
1994	All	All holding cages must be legibly marked with the registration number of the R licensed vessel used to harvest the crabs.	All	0	Y	1994
1994	All	Crab exports from B.C. that have not been through a federally registered processing plant must be reported.	All	0	Y	1994
1994	All	Electronic copies of harvest logs required for submission with paper copies.	All	0	Y	1994
1994	Area B	Area B closed from October 25 to November 8 for noncompliance with catch reporting requirements.	B	3	N	1994
1994	5-4 to 5-8	Kitkatla Inlet closed during Herring season March 15 to April 15, 1994.	B	5.4	A	1994
1994	Area D	Setting and hauling crab traps permitted only between 1 hour before sunrise and 1hour after sunset.	D	28	Y	1994
1994	Area D	Fraser River area closed to commercial fishing January 1 to July 14, 1994 for soft shell.	D	28	A	1994
1995	All	Sport fishers required to have a BC Tidal Sport fishing licence to harvest crab.	All	0	Y	1995
1995	1, 101, 102, 104, 105-1	Dogfish bank and McIntyre Bay closed to all fishing September 7 for Domoic Acid. Area reopened later that fall except 101-10 which remained closed until January 1996.	A	1	N	1995
1995	3-15	Portland Canal north of Green Islets closed all year for Sport Access. Portland Canal between Belle Bay and Green Islets closed January 1 to September 30 for Sport Access.	B	3.15	Y	1995
1995	4-12, 4-15	Buoys optional in the Skeena River estuary during salmon openings.	B	4.12	Y	1995
1995	Area D	300 trap limit in Area D, the Fraser River.	D	28	Y	1995
1996	All	Reports of crab exports required at least 24 hours prior to export.	All	0	Y	1996
1996	All	Barges, packers and mother ships not permitted in the crab fishery.	All	0	Y	1996
1996	All	Rot cords or rot panels required in sport traps. Rot panels to exceed 11 cm by 11 cm or 7 cm by 20 cm.	All	0	Y	1996
1996	Area A	All of Area A closed from June 1 to July 15 for soft shell.	A	1	Y	1996
1996	Ptn 1-5, 101-7, 101-10	McIntyre Bay closed from June 1 to September 21 for soft shell.	A	1.5	Y	1996

1996	5-4 to 5-8	Kitkatla Inlet closed annually during Herring season March 10 to April 15.	B	5.4	Y	1996
1996	6-3, 6-4	Ursula Channel and Gardner Canal closed to commercial fishing January 1 to October 1 for Native and Sport Access. October 1 selected to align closure with others in Area B.	B	6.3	Y	1996
1997	All	Buoys used for crab traps must exceed 12 cm in diameter and a volume of 2.5 liters.	All	0	Y	1997
1997	All	Vessels required to select one area in which to fish for a period of 3 years.	All	0	Y	1997
1997	All	Rot cords may only be used on hinged lid traps with a total volume less than 400 litres. All other traps must be equipped with rot panels. (In response to traps with lids to heavy for a crab to escape from.)	All	0	Y	1997
1997	Area A and B	Rot panels must exceed a square 35 cm by 35 cm or a "V" 50 cm on each leg in Areas A and B to protect King Crab.	A & B	0	Y	1997
1997	Area A	Industry funded soft shell monitoring program in Area A during the June 1 to July 31 closure.	A	1	Y	1997
1997	Area A and 102-2, 105-2, 106-1	Area A soft shell closure to include offshore Subareas 102-2, 105-2 and 106-1. The soft shell closure was extended for June 1 to July 31 due to soft crab encountered in the monitoring program.	A	1	Y	1997
1997	101-10	McIntyre Bay closure description modified to exclude that portion of 101-10 south east of Rose Spit.	A	1.5	Y	1997
1997	Ptn 3-12, 3-18	Nass River estuary (3-12 north of Arrandale and south of Nass Pt.) and Iceberg Bay closed January 1 to October 1 to November 16 to December 31 for Native and Sport Access.	B	3.12	A	1997
1997	Area C	Area C was divided into Area G (Areas 11, 12, 13 and 15) and Area H (Areas 14, 16 to 19, and Subarea 29-5).	C	11	Y	1997
1997	Area D	Gear may be transported to the grounds with packers or barges on opening day only in Areas I & J.	D	28	Y	1997
1997	Area D	Area D was divided into 2 areas as a 1 year pilot within the three year licence term, Area I (Areas 28 and 29 excluding subareas 29-5 and 29-8) and Area J (Subarea 29-8).	D	28	Y	1997
1997	Area I	Area I closed to commercial fishing January 1 to June 23, 1997.	I	28	Y	1997
1997	29-8	Single trap gear only in Boundary Bay	J	29	Y	1997
1997	Area J	Area J closed to commercial fishing January 1 to July 31, 1997.	J	29.8	Y	1997
1998	Area A	Single trap gear proposed for Area A effective May 1, 1998.	A	1	P	1998
1998	Area A	Traps fished in Area A must be marked with the registration number of the vessel fishing the traps.	A	1	P	1998
1998	Area B	110 mm escape holes required in all traps fished in Area B	B	3	Y	1998
1998	Ptn 3-12	Kinkolith half mile ribbon boundary between Nass Pt and Fort Pt redescribed after the definition of a ribbon boundary was challenged in court.	B	3.12	A	1998
1998	Areas G & H	Setting and hauling crab traps permitted only between 1 hour before sunrise and 1hour after sunset.	G & H	11	Y	1998
1998	Ptn 19-3	Ogden Pt. Marine Reserve closed to crab fishing.	H	19.3	Y	1998
1998	Ptn 20-2	A portion of Port Renfrew closed to commercial fishing for Native and Sport Access.	E	20.2	Y	1998
1998	Ptn 23-8	Broken Group Islands of Pacific Rim National Park closed.	E	23.8	Y	1998
1998	Area I	Area I closed to commercial fishing January 1 to June 23 and November 30 to December 31, 1998.	I	28	Y	1998
1998	Areas I & J	Area D divided into 2 areas for the remainder of the three year licence term, Area I (Areas 28 and 29 excluding subareas 29-5 and 29-8) and Area J (Subarea 29-8). Vessels to select either Area I or Area J for 2 years.	I & J	28	Y	1998
1998	29-8	Area J closed to commercial fishing January 1 to July 24, 1998.	J	29.8	Y	1998

Table 4.1.9. Crab closures due to dioxins and furans.

LOCATION	DATE	Subareas	ACTION
Prince Rupert	30-Nov-88	Ptn 4-11	Closure to all fishers: Wainwright Basin and Porpoise Harbour
Prince Rupert	14-Jun-80	Ptn 4-11, Ptn 4-12	Commercial closure and consumption advisory on hepatopancreas imposed in Morse Basin and in vicinity of Coast Island
Prince Rupert	27-Aug-93	Ptn 4-10	Commercial closure and non-commercial consumption advisory on hepatopancreas extended to west of Kaien Island
Prince Rupert	14-Aug-95	4-10, Ptn 4-11	Contamination closure lifted in area of Morse Basin northward to include Prince Rupert harbour area. Area allocated to Native and Sport crab fishing only.
Prince Rupert	18-Apr-96	Ptn 4-12	Contamination closure lifted in vicinity of Coast Island. Area re-opened to commercial crab fishing September 24, 1996 after consultation with commercial fishers.
Kitimat	23-Nov-89	Ptn 6-1	Commercial closure and non-commercial consumption advisory on hepatopancreas imposed in Kitimat Arm.
Kitimat	29-Nov-90	Ptn 6-1	Commercial Closure and non-commercial consumption advisory on hepatopancreas extended to Coste Island.
Kitimat	18-Apr-96	Ptn 6-1	Contamination closure in Kitimat Arm lifted (area allocated to Native and sport fishers)
Campbell River (Elk Falls)	23-Nov-89	13-5, Ptn 13-3	Commercial closure and non-commercial consumption advisory on hepatopancreas imposed in western part of Discovery Passage
Campbell River (Elk Falls)	29-Nov-90	13-4, 13-5, Ptn 13-3	Commercial closures and non-commercial consumption advisory on hepatopancreas extended to include the total area between Race and Mudge Points.
Campbell River (Elk Falls)	09-Aug-91	13-3, 13-4, Ptn 13-5	Commercial closure and non-commercial consumption advisory on hepatopancreas extended to north of Maud Island. Excludes Menzies Bay.
Campbell River (Elk Falls)	27-Aug-93	13-3, 13-4, 13-5, 13-6, Ptn 13-8, Ptn 13-14	Commercial closure and non-commercial consumption advisory on hepatopancreas extend north to Cape Mudge and west to Menzies Bay; Kanish Bay included; portion of Sutil Channel near Francisco Point added.
Campbell River (Elk Falls)	10-Feb-95	13-3 to 13-6, Ptn 13-7, Ptn 13-8, Ptn 13-9, Ptn 13-10, Ptn 13-14,	Commercial closure and non-commercial consumption advisory on hepatopancreas extended northwards to include Deepwater, Elk and Chonat bays
Campbell River (Elk Falls)	18-Apr-96	Ptn 13-9	Contamination closures lifted in Elk Bay. Commercial fishery re-opened January 1, 1997.
Campbell River (Elk Falls)	08-Sep-97	Ptn 13-12	Commercial closure and non-commercial consumption advisory on hepatopancreas for Owen Bay.
Powell River	23-Nov-89	Ptn 15-1, Ptn 15-2	Closure to all fishers: Harwood Island to Powell River area.
Powell River	29-Nov-90	Ptn 15-1, 15-2	Commercial closure and non-commercial consumption advisory on hepatopancreas imposed from Hernando Island to north Texada Island

Table 4.1.9. Crab closures due to dioxins and furans. (con't)

LOCATION	DATE	Subareas	ACTION
Powell River	10-Feb-95	Ptn 15-1, Ptn 15-2	Harwood Island-Powell River area (immediately adjacent to the pulp mill) re-opened to non-commercial fishers with a consumption advisory on hepatopancreas; continued commercial closure.
Powell River	14-Aug-95	Ptn 15-1, Ptn 15-2	Contamination closure lifted Powell River area from north end of Texada Island to Hernando Island, except area immediately adjacent to pulp mill (east of Harwood Island). Commercial fishery reopened September 12, 1995.
Nanaimo (Harmac)	23-Nov-89	Ptn 17-13, 17-15, 17-16	Commercial closure and non-commercial consumption advisory on hepatopancreas imposed in Northumberland Channel.
Nanaimo (Harmac)	29-Nov-90	Ptn 17-13, 17-15, 17-16	Commercial closure and non-commercial consumption advisory on hepatopancreas extended to north end of Newcastle and Gabriola islands.
Nanaimo (Harmac and Crofton)	09-Aug-91	Ptn 17-4, Ptn 17-6, Ptn 17-7, 17-9, Ptn 17-13, 17-15, 17-16	Commercial closure and non-commercial consumption advisory on hepatopancreas extended Clark Bay to south of Link Island.
Nanaimo (Harmac and Crofton)	27-Aug-93	Ptn 17-4, Ptn 17-5, Ptn 17-6, Ptn 17-7, 17-9, Ptn 17-12, Ptn 17-13, 17-15, 17-16, Ptn 17-17	Commercial closure and non-commercial consumption advisory on hepatopancreas extended from Reynolds Point south to Kulleet Bay; area between Link Island and northern Valdes Island added.
Nanaimo (Harmac)	14-Aug-95	Ptn 17-12, Ptn 17-13, 17-15, 17-16. Ptn 17-17	Contamination closure lifted in entire area north of Reynolds Point-north Valdes Island to Newcastle Island-northern tip of Gabriola Island. Commercial fishery re-opened September 12, 1995.
Crofton	23-Nov-89	17-5,17-6, 18-8	Commercial closure and non-commercial consumption advisory on hepatopancreas imposed in Stuart Channel and Cowichan Bay
Crofton	29-Nov-90	18-7	Commercial closure and non-commercial consumption advisory on hepatopancreas expanded to include Burgoyne Bay
Crofton	09-Aug-91	17-9, Ptn 17-6, Ptn 17-9	Commercial closure and non-commercial consumption advisory on hepatopancreas extended north to Ladysmith Harbour; Maple Bay added.
Crofton	14-Aug-95	18-8	Contamination closure lifted in Cowichan Bay (Area closed to commercial fishing for access by native and sport fishers)
Gold River	23-Nov-89	Ptn 25-1	Closure to all fishers: eastern Muchalat Inlet
Gold River	29-Nov-90	25-1, 25-2, 25-3	1989 closure to all fishers extended to include all of Muchalat Inlet
Gold River	27-Aug-93	Ptn 25-4	Commercial closure and non-commercial consumption advisory on hepatopancreas imposed for Hisnit Inlet.
Gold River	10-Feb-95	25-1,25-2, 25-3	Muchalat Inlet re-opened to non-commercial with consumption advisory on hepatopancreas; commercial closure continues.
Gold River	14-Aug-95	Ptn 25-4	Contamination Closure lifted in Hisnit Inlet, commercial fishery reopened September 12, 1995.
Howe Sound	30-Nov-88		Closure to all fishers: northern and western areas of Howe Sound
Howe Sound	14-Jun-89		1988 closure to all fishers extended southward

Table 4.1.9. Crab closures due to dioxins and furans. (con't)

LOCATION	DATE	Subareas	ACTION
Howe Sound	27-Aug-93	28-1, 28-2, 28-3, 28-4, 28-5, 29-1, Ptn 29-2, Ptn 29-3	Commercial closure and non-commercial consumption advisory on hepatopancreas extended south and west in Howe Sound
Howe Sound	10-Feb-95	28-4, 28-5	Northern area of Howe Sound re-opened to non-commercial fishers with a consumption advisory on hepatopancreas; commercial fishing closure/non-commercial hepatopancreas consumption advisory extended on western portion of Howe Sound to Reception Point.
Howe Sound	14-Aug-95	28-4, 28-5	Contamination closure lifted in upper Howe Sound (north of Anvil Island). Commercial fishery re-opened with following season (July 2, 1996).
Howe Sound	18-Apr-96	Ptn 28-1, 28-3	Area adjacent to Port Mellon pulp mill re-opened to non-commercial fishers with a consumption advisory on hepatopancreas; continued closure to commercial fishers.
Vancouver Hbr	01-May-92	28-10	Closure to all fishers: Burrard Inlet between Lion's Gate Bridge & Second Narrows Bridge
Vancouver Hbr	1991?	28-10	Contamination closure lifted. Fishery remains closed due to navigational hazard.
Victoria Hbr.	01-May-92	19-1	Commercial closure and non-commercial consumption advisory on hepatopancreas imposed from Macaulay Point to Chapman Point

Figure 1. Dungeness Crab Landings 1980 - 1997

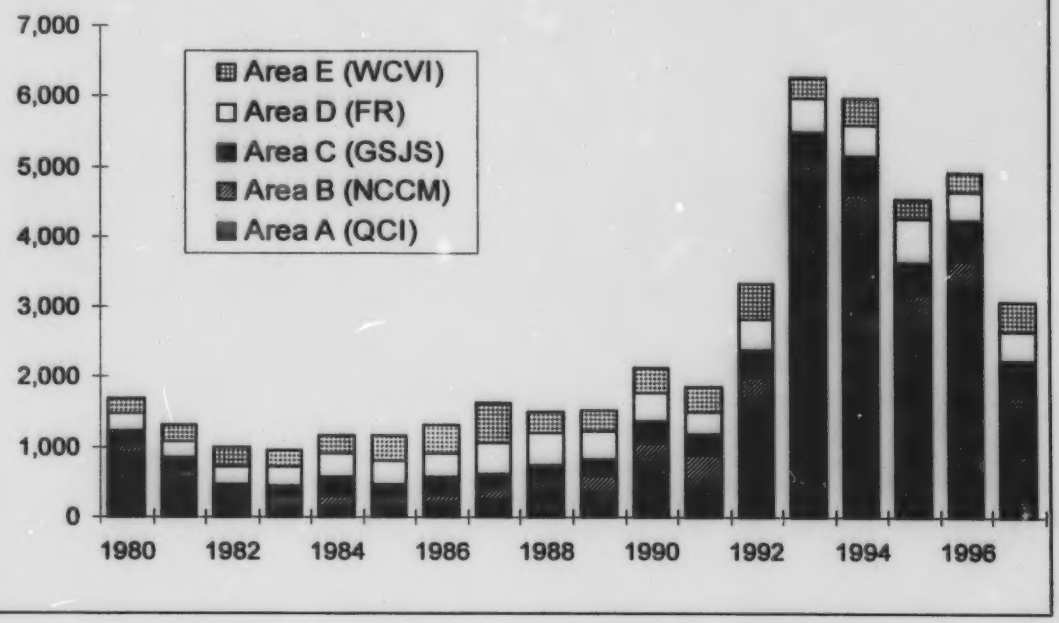
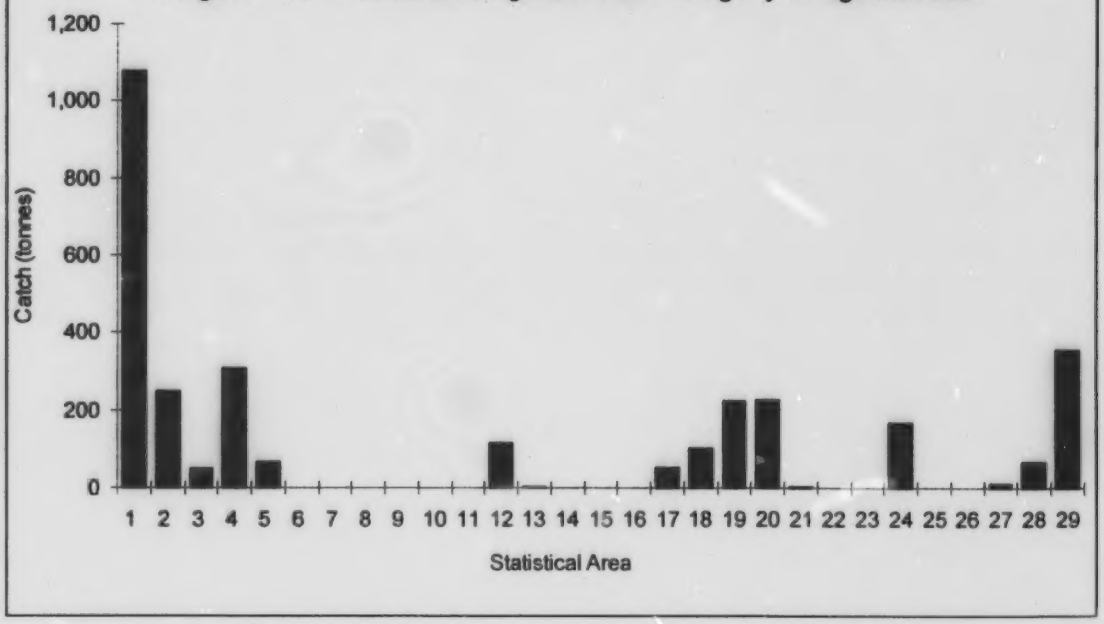


Figure 2. 1997 Commercial Dungeness Crab Landings by Management Area.



4.2. Shrimp Trawl Fishery (1997/98) - K. Southey, R. Harbo and J. Boutillier

4.2.1 Introduction

The British Columbia shrimp trawl fishery has traditionally targeted primarily on three species of shrimp: *Pandalus jordani* (smooth pink), *P. borealis* (northern or spiny pink) and *Pandalopsis dispar* (sidestripe). Humpback shrimp, *Pandalus hypsinotus*, coonstripe (or dock) shrimp, *P. danae*, flexed pink, *P. goniurus*, and prawns, *P. platyceros* have been caught incidentally or in small quantities in this fishery.

A category "S" licence is required for participation in this fishery. This licence was limited in 1978. For the 1997/98 season, 248 licenses were eligible for this fishery, a reduction of 1 from 1996. For the period 1987 to 1994, the number of vessels participating in this fishery ranged from 158 to 190 (Table 4.2.1). In 1995, the number of active vessels increased to 216 and to 222 in 1996.

Changes in the management of the shrimp trawl fishery were implemented in 1997 and resulted in the creation of Shrimp Management Areas ("SMA"'s) (Figure 1).

4.2.1.1 Historical effort and landings

The distribution of fishing activity has expanded throughout the coast as a result of increased fishing effort within the shrimp trawl fleet. Small vessels deploying beam trawls have been generally used in the inshore fisheries whereas larger vessels using otter trawls have tended to fish offshore areas.

The range of smooth pink shrimp, *P. jordani* is from California to Unalaska Island, with commercial concentrations extending from California to Chatham Sound (Butler, 1980; Jensen, 1995). Historically 80% to 90% of B.C.'s shrimp landings are taken from the offshore areas along the west coast of Vancouver Island, and focus primarily on this species (Figure 2; Table 4.2.3). Landings have fluctuated widely varying between 5,000 tonnes (t) in 1978 to 225 t in 1980 (Boutillier, 1987). Since 1987 and up to 1994, however, these fisheries have sustained annual landings of 2,000 to 3,000 t (Table 4.2.3) of shrimp annually from areas commonly known as the "Barkley, Tofino and Nootka Grounds" (Areas 23-123: listed in fish slip data as Area 23; 124: listed in fish slip data as Area 24; and 125: listed in fish slip data as Area 25).

From 1989 to 1994, the number of active vessels in the B.C. shrimp fleet remained relatively constant, ranging from 164 to 185 vessels. However, the number of vessels with reported landings increased from 165 vessels in 1994 to 222 in 1996 (Table 4.2.1).

In 1995, 249 vessels were eligible to fish under the "S" Licence of which only 6 were single "S"-licensed vessels. This has changed to 67 single "S"- licenced vessels in 1997.

In 1996, the fleet expanded its efforts in areas other than the West Coast of Vancouver Island (Figure 2), and the result was unprecedented catches in Areas 3, 4, 5, 7, 8, 9, 10, 12, 18, and 19 (Tables 4.2.2 and 4.2.3). With the change in the licence year from mid-April to mid-April of the following year, rather than the calendar year, results from 1997 are presented in a later section. Consistent with the trend of the past number of years, the largest portion of the 1996 catch was taken from the offshore areas (Areas 123, 124 and 125) on the Barkley Sound, Tofino and Nootka grounds.

North coast shrimp production increased to 1,734 t in 1996 (Table 4.2.2.) from stable landings averaging 60 t for the years 1982 to 1994. The high of 133 t was reported in 1990. Catches for

1995 totalled 239 t. As in previous years the majority of this catch was reported from Area 4 (Chatham Sound fishery). Landings for 1996 in the north coast show significant increases in Areas 4, 7 and 8. This increase represents a movement of the fleet to target on pink shrimp in Chatham Sound and the central coast offshore areas. Again, landings are confused by the lack of separation of offshore areas in the fish slip databases.

The Fraser River (Areas 28 and 29) 1996 shrimp catch of 192 t represented a catch greater than the long term average of 141 t (Table 4.2.3.). Areas 13 to 19, Strait of Georgia shrimp landings totalled 450 t. Catch increased in all of the traditional fishing areas, in particular in Area 14 and record landings in Area 18. Northern Vancouver Island and mainland Areas 11, 12, saw unprecedented landings in excess of 600 t.

4.2.1.2 Historical Landed Values

Landed values are complicated by the different species and products- machine-peeled shrimp, hand-peeled shrimp, live shrimp, and large shrimp frozen at sea (FAS). The landed value of the pink shrimp fishery is highly dependent on landings and ex-vessel prices in the Washington, Oregon and California shrimp fisheries which tend to dwarf the British Columbia fishery by comparison. The landed value of the B.C. shrimp fishery has varied between $2.6 M and $4.8 M annually from 1987 to 1994 when this fishery showed a resurgence (Table 4.2.1). The 1995 fishery showed a record total landed value of $13.7 million, an increase of $8.9 million from 1994, and the 1996 fishery showed a total landed value of $11.0 million, despite the higher landed tonnage compared with 1995 (Table 4.2.1). Ex-vessel prices vary considerably due to seasonality of the fishery, competition with foreign product, and the occurrence of larger shrimp, sidestripe and humpback shrimp, in the inshore fisheries, which sell for a higher price than pinks.

4.2.1.3 Overview of Other Pacific Coast Shrimp Trawl Fisheries

Washington State- 1997

In the Washington State inshore shrimp fishery there were 8 beam trawlers for the inside fishery, following licence limitation and a minimum annual landing requirement.

There was a fishery in the San Juan Islands, where the primary catch is coonstripe or dock shrimp (*P. danae*) and a few sidestripes, humpback and spot (prawn) shrimp. The annual arbitrary TAC is 100,000 lb. (45 t).

In eastern Juan De Fuca Strait, in 1995, some fishermen had "phenomenal" CPUE's . This was a beam trawl fishery by regulation. A catch ceiling was set at 700,000 lb. (317.5 t), a limit based on an average of three year's landings. This was increased in season to 1.2 million lb. (544 t) the historic high catch. This fishery was for the spiny pinks, *P. eous* (=*P. borealis*), different from the offshore pinks (*P. jordani*).

It is estimated that the Washington offshore pink shrimp fishery lands 10 to 15 million lb. of pinks (*P. jordani*) annually. (Jay O'Donnell, pers. comm.).

Oregon

Oregon has an offshore fishery for pink shrimp, *P. jordani.* The season is open from April 1 to October 31, with approximately 180 vessels eligible following limited entry. Landings in the past three years have been low, 12 to 16 million lb. (5443 to 7258 t) annually compared to a 15 year average of 26 million lb. (11,794 t).

The counts /lb. are regulated to >160 whole shrimp/lb. averaged through the load. There have also been concerns about bycatch and limits set to eliminate hake bycatch and limits set for yellowtail rockfish.

When CPUE drops below 100 lb./hr. and the prices are low (<$1/lb.), fishermen don't go out.

The pink fishery has experienced ups and downs. The fishery did recover from landings of <5 million lb. in 1984 to 50 million lb. five years later. (Steve Jones, pers. comm.)

Alaska

There are four management regions in Alaska. Some areas are restricted to beam trawls only. There are a variety of seasonal closures and "guideline harvest levels". Seasons vary from district to district. Arbitrary "guideline harvest levels" are in place for many shrimp trawl fisheries. These levels vary considerably from area to area. (Doug, Mecum, Al Spalanger and Dave Jackson, pers.comm)

1. Westward (Area J): Kodiak-Alaska Peninsula

This fishery began in 1960 and had landings of 119 million lb. (53,978) at the peak of the Alaska shrimp fishery (1976- 129 million lb. or 58,514 t were landed). Kodiak, the Alaskan Peninsula and Cook Inlet are currently closed due to poor stock conditions. The westward region has been closed to shrimp trawling since 1985. There is a minimum population threshold set for this fishery; the stocks have been below this level for more than a decade. An area swept trawl survey is undertaken in this area every three years.

2. Prince William Sound (Area E)- Cape Fairfield

There has been a trawl fishery for sidestripes in this area.

3. Cook Inlet (Area H)/ Outer Cook Inlet(Area G)

Kachemak Bay considered separate shrimp stocks from other Gulf of Alaska stocks. In the past, the fishery has sustained annual harvest levels of 5 million lb. of pink (*P. eous*) and "humpy" or flexed pink shrimp (*P. goniurus*). The area was closed in 1997/98 due to poor stock levels.

4. Se Alaska-Cape Fairweather To Dixon Entrance Petersburg (Area C)

The shrimp fishery began in this area in 1915, targeting on pinks. The beam trawl fishery landed approx. 3 million lb. in the 1995/96 season.

5. Yakutat- Cape Fairweather To Cape Suckling (Area D)

No Shrimp Trawl Fishery

4.2.2 Biological Objectives for Shellfish Fisheries

The general biological objective of ensuring conservation and protection of shellfish stocks coastwide through the application of scientific management principles is applied to this fishery. Specifically the conservation and sustainability goals are met through the setting of precautionary catch ceilings and the development of a biologically based management system that will utilize a combination of fixed exploitation rates and critical threshold levels.

4.2.3 Management Objective for Shellfish Fisheries

Specific management objectives were not developed for this fishery. However, general shellfish goals apply to the management of the shrimp trawl fishery as described at the beginning of this document section 1.6.

The following were identified as priority issues:

1. A biological database needs to be established in order to properly assess shrimp stocks in the inshore areas and to develop an effective management plan for this fishery.
2. Bycatch allowance of prawns should be addressed in consultation with the Prawn and Shrimp by Trap committee due to problems of non-compliance with regard to non-retention of prawns during closed times for prawn and shrimp by trap.
3. Delaying the opening of at least a portion of the offshore fishery until May, to take advantage of a spring growth period, would result in an increased yield per recruit and better quality product from the fishery. Although industry has rejected this for economic reasons, further consideration is warranted considering the increased landings and value of this fishery. Reports of catches of high counts continue to raise concern in the offshore pink shrimp fishery.
4. Public concerns regarding the bycatch of other fin fish species, particularly in the inshore areas, have escalated during 1994 and 1995. Consultation on gear selectivity devices is required as well as quantification of actual bycatches.

The above items 1, 2, and 4 were specifically addressed in the1997/98 management plan but item 3 was not adopted based on advice from the Shrimp Trawl Sectoral Committee. They requested an April 1 opening to have shrimp on the market and establish a price before the U.S. fishery set market prices.

4.2.4 Historical Fishery Management Actions in the Shrimp Trawl Fishery (prior to 1997/98 season).

A summary of the history of management actions in the shrimp trawl fishery is given in Table 4.2.6. The only areas actively managed were the offshore grounds on the west coast of Vancouver Island, where quotas and seasonal closures were implemented. Catches in all areas are monitored by sales slips and mandatory vessel harvest logs that have been a condition of licence since 1987. However, there is a historical problem in the sales slip data that does not separate offshore areas from inshore areas.

As a result of increasing fishing effort in 1995, both in fishing time and participation in the fishery, particularly Area 23/123 and the record high catch landed from this area, industry met several times to discuss a winter closure for 1996. Although scientific evidence is limited, stocks in the lower offshore area (Area 23/123) may provide recruitment for shrimp grounds further up the west coast of Vancouver Island. In addition, there was concern that with more of the otter trawlers using extruder grids, previously unfished grounds were being exploited. As a precautionary measure, the fishery was closed from January through March 1996 to protect the stock, particularly the berried females, from further exploitation. Shrimp larvae complete hatching between March and May.

Bycatch restrictions have been set since 1990 to limit the capture of prawns, squid and groundfish. Groundfish cannot be retained and squid are limited to 2% of the total weight of shrimp on board. Bycatch restriction on prawn (spot shrimp, *P. platyceros*) are required as the trawl gear is non size selective and results in mortality of sub-legal sized prawns when caught. In all areas, retention of prawn is prohibited during prawn and shrimp by trap fishery closures for conservation reasons and a small bycatch limit is in effect during prawn by trap open times. A commercial trap fishery for prawn is licensed separately and the number of licences are limited. In 1995, the retention of trawl caught prawn in Area 17 was prohibited year round as a conservation concern for prawns. The capture of prawns and the associated mortalities appeared to be a problem in this area.

4.2.5 Management Changes for the 1997/98 Shrimp Trawl Fishery

The new management plan included the following changes, released in June of 1997.

1. A CHANGE IN THE LICENCING YEAR, to be effective from April 16 to April 15 in the year following. This follows the biological shrimp year more closely. The licence period was initially changed as follows: "S" Licences issued in 1997 expired on December 31, 1997. A licence amendment and new licence conditions were issued for the period January 1 to April 15, 1998.
2. SHRIMP MANAGEMENT AREAS WERE DEVELOPED FOR 1997/98 (Figure 1).
3. CATCH CEILINGS WERE INTRODUCED FOR MOST SHRIMP MANAGEMENT AREAS. They were set for the period April 1, 1997 to March 31, 1998. (see the Catch Ceiling section following).
4. PRAWN BYCATCH RESTRICTIONS. The minimum size limit for prawn was increased to 33 mm carapace length and the limit on prawns were described as 5 lb. whole, in the shell, provided that the area was open to fishing for prawn shrimp by means of trawl gear.
5. NOTIFICATION PRIOR TO COMMENCEMENT OF FISHING was required in the form of a fishing hail to the designated service bureau through a 1-800 number.
6. NOTIFICATION PRIOR TO OFFLOADING WAS REQUIRED in the form of a landing hail to the designated service bureau through a 1-800 number.
7. A NEW CATCH MONITORING PROGRAM was implemented to monitor landings and track catch ceilings. The requirements were for submission of an estimated weight of harvested catch by the fisher within 48 hours of landing, and of a final weighed-out weight within 7 days of sale to the Designated Service Bureau. All catch was to be reported on a Shrimp Trawl Landing Record from a DFO approved Shrimp Trawl Landing Record Book.
8. A LIMITED DOCKSIDE VERIFICATION PROGRAM was implemented which enabled dockside observers to verify, sample, and inspect landings.
9. THE LOGBOOK WAS REDESIGNED to include fishing hail numbers and tow locations. Latitude/Longitude tow locations shall be reported in the logbook reports. For those vessels not equipped with the appropriate instruments, fishing position was to be indicated on a chart record of the locations fished.
10. The time frame for the submission of Logbook Records was changed. Logbook records were to be submitted within 7 days of landing instead of within 28 days of landing.
11. For the proper identification and reporting of catch by species on Logbooks and Landing Records, illustrations of the common commercial shrimp species were attached to the plan, and a colour plate was included in the Logbook.
12. A BYCATCH MONITORING PROGRAM WAS IMPLEMENTED to monitor bycatch in all fishing areas. Vessels were selected to participate in the program based on effort and areas fished.
13. THE SHRIMP TRAWL SECTORAL COMMITTEE WAS RE-ELECTED IN THE FALL OF 1997.

4.2.5.1 Catch Ceilings And Quotas for April 1, 1997 to March 31,1998.

In 1996, fishery Managers, stock assessment scientists and the Pacific Stock Assessment Review Committee (PSARC) recommended that precautionary catch ceilings be implemented to protect inshore shrimp stocks. Concerns for inshore stocks were identified by Boutillier and Joyce (1996). South coast inshore Areas showed low or declining annual CPUE indices for most shrimp fishing areas. In Area 28/29, the population of sidestripes was exhibiting what was believed to be the compensatory response of a stressed stock by producing primary females. This may be considered as a sign of over-exploitation.

The grouping of areas and the development of shrimp management areas were discussed at Shrimp Sectoral Committee meetings held January 14 and February 10, 1997. Figure 1 shows the shrimp management areas for 1997/98. Table 4.2.7, presents the proposed catch ceilings that were developed by fishery managers, biologists and stock assessment biologists, and reviewed by the Committee. **It is important to note that the precautionary catch ceilings limited growth of the fishery in inshore areas at a level above the 1994 fishery.** For comparison, catch ceilings set for 97/98 totalled 1,622 t, for areas in which the reported landings were 1,095 t in 1995.

Industry members of the committee suggested alternative management actions based on in-season evaluation of CPUE from logs and requested that precautionary ceilings in areas with little or no history of exploitation be increased to 50 t DFO was not confident that CPUE was a reliable in-season index and maintained that catch ceilings were required as a precautionary measure to protect the long term viability of shrimp stocks. Managers also decided to maintain the lower, more conservative level of 10 t in areas with no historical shrimp trawl fisheries.

4.2.5.2 Seasonal Closures Options – January 1 to March 31

Industry recommended a coastwide three month closure, January 1 to March 31, for areas of WCVI without catch ceilings as a conservation measure. The department's review of reported effort and landings suggested that such a closure alone, without catch ceilings, would not limit the rapidly escalating effort and landings, particularly on inshore stocks at risk from over-exploitation. A review of monthly landings in 1995 for the west coast of Vancouver Island showed that only 4% of the annual landings were harvested during this period of generally poor weather. Similarly, coastwide landings were also only 4% during this period in 1995, 7% in 1994, and 8% in 1993 (Joyce and Boutillier, 1996).

For some of the inside areas, however, there were reports of significant landings during the period, January to March:

- Area 14 had a history of significant landings in January-March.
- Area 15- in some years all of the landings were in the period, January-March.
- Area 17- in 1996, most of the landings were in the winter period, January-March.
- Area 28-29, for many years this period had a significant proportion of the annual landings.

(This will be a problem if catch ceilings are taken before January 1 in these Areas).

Seasonal closures may have been effective in preserving stocks in some areas, but were considered a high risk option for the entire coast. Based on a review of the annual increases in landings and effort (Tables 4.2.1, 4.2.2, 4.2.3), they were expected to significantly increase over an unrestricted nine month season.

The west coast of Vancouver Island was opened on April 1, 1997 with a notice that an assessment of historical environmental and shrimp survey information would be undertaken for PSARC meetings in July. Boutillier et al. (1997) and the PSARC subcommittee recommended that the risk averse approach of precautionary quotas be implemented until further surveys and

data were collected. The analyses determined that there was a stock recruitment relationship present in these populations with variations in stocks resulting from environmental conditions.

4.2.5.3 North Coast Catch Ceilings

North Coast landings varied between 20 and 132 t annually between 1982 and 1994. Record landings were generated in 1995 and 1996 of 239 and 1,746 t respectively (Table 4.2.2). In 1996, North Coast landings increased to 24% of the coastwide catch.

Arbitrary precautionary catch ceilings of 10 t were set for many areas. Some of these were landed before the end of the 1997/98 management year, while others have as yet received little effort (Tables 4.2.7, 4.2.9).

Area 1/101 (DXE)

Historically this is a humpback (*P. hypsinotus*) fishery in Masset Inlet using trap gear, in areas considered to be too shallow for trawl. Trawl gear is primarily used in Area 101. A 10 t catch ceiling was set by DFO. Industry had requested an increase with a 50 t ceiling offshore to encourage exploration for pinks, and a separate humpback 10 t ceiling for the inshore.

Area 2/102, 142 (QCI)

This area has largely unknown potential with historical records of only one boat fishing. Industry requested an exploratory quota of 50 t as an incentive to look for stocks. It was suggested by DFO that the policy governing new and developing fisheries should be invoked in areas with no fishing history. It was subsequently proposed by DFO that an arbitrary quota be implemented with a rider for local in-season closures if the fleet becomes concentrated. Comments were put forward that pink and sidestripe stocks are more separated by depth than area.

Area 3-5 to 3-16 (3IN)

No fishing history exists for this area. DFO wanted to separate this area from the Chatham Sound directed fishery, as the inlets may be at more risk for overfishing. Comments from industry included that there is a sidestripe fishery in Portland Canal, that the Subareas are not fished because they are more isolated than Chatham Sound, that small sidestripes are caught and sold as pinks, and that the DFO proposed 10 t catch ceiling is too low.

Chatham Sound, Areas 3-1 to 3-4, 4-1 to 4-12, 5-1, 5-2, 5-23 ,103 and 104 (PRD)

In 1996, up to 35 boats fished in a combination of Areas 3, 4, and 5. There were two different fisheries in Chatham Sound; Subareas 4-9 and 4-12, were primarily the target of a pink fishery in 1996. A fishery for sidestripes has been steady for the past 5 years. Industry advised that a 100 t catch ceiling was too small compared to the 1996 fishery. Industry recommended separate ceilings for each species.

The Chatham Sound fishery for pinks and sidestripes was limited at 220,460 lb. (100 t) of pinks and 220,460 lb. (100 t) sidestripes. In the past, landings have been limited by the lack of buyers in the north coast.

Area 5-3 to 5-10, 5-12 to 5-19, 5-24 (5IN)

Grouped as an inshore area. The precautionary catch ceiling was set at 10 t.

Areas 6-1 to 6-8, 6-10 to 6-12, 6-14 to 6-16, 6-18 to 6-28 (6IN)

Grouped as an inshore area. The precautionary catch ceiling was set at 10 t.

Areas 5-11, 5-20, 5-22 and 105 (5OFF)

Grouped as an offshore area, the precautionary catch ceiling was set at 10 t.

Areas 106, 6-9, 6-13, 6-17 (6OFF)

Grouped as offshore. The precautionary catch ceiling was set at 10 t.

Areas 7-2 to 7-25, 7-27 to 7-30 (7IN)

Grouped as inshore. The precautionary catch ceiling was set at 10 t.

Areas 8-2 to 8-16 (8 IN)

Grouped as an inshore area. The precautionary catch ceiling was set at 10 t.

Area 9 - Fitzhugh Sound (9IN)

Industry commented that this is a sidestripe area. The 10 t catch ceiling proposed by DFO would take one boat about 2 weeks to catch in good conditions. Industry expressed doubt that grid surveys would work for sidestripes, and proposed to manage by Subarea for sidestripes considering the small boat fleet. Fishermen estimated that a minimum of 300,000 lb. (136 t) of pinks were landed from Subarea 9-12 in 1996. This was not supported by logbook reports.

The precautionary catch ceiling was set at 10 t.

Areas 10-3 to 10-12 (10 IN)

Grouped as an inshore area. The precautionary catch ceiling was set at 10 t.

Areas 107, 7-1, 7-26, 7-31, 108, 8-1, 109, 110, 10-1 10-2, 111, 11-1, 11-2 (QCSND)

Grouped as an offshore area. Industry commented shrimp were very mobile in these areas, and that sidestripes increase when pinks decrease. Industry flet the Goose Grounds are huge and new fishing grounds should be treated like Nootka and Tofino grounds, as an event driven fishery. Industry recommended no catch ceiling, however, if a catch ceiling was to be set, they recommended splitting this area at the 129^0 longitude, with a catch ceiling for east of the line only and open for exploration to the west of the 129^0 line.

The Queen Charlotte Sound fishery level was set at 1,322,750 lb. (600 t), an arbitrary, precautionary 50 % reduction from the landings of 1,157 t reported from Areas 7 and 8 in 1996 (Table 4.2.2.). A fishery independent survey was recommended but not achieved in 1997.

4.2.5.4 South Coast Catch Ceilings

Shrimp landings from the east coast of Vancouver Island have ranged between 165 and 340 t annually since 1982 with the majority of the catch being landed in Areas 14, 28 and 29. The 1994 and 1995 landings were still within this range at 235 t and 344 t respectively, while 1996 landings increased dramatically to 1,250 t, due primarily to increases in landings in Areas 11,12, and 18 (Table 4.2.3).

Areas 11-3 to 11-10 (11IN)

Grouped as an inshore area. DFO recommended 10 t, Industry recommended 50 t. The precautionary catch ceiling was set at 10 t.

Area 12 (12IN, 12OUT)

Due to the rapid increase in landings in Area 12 (Table 4.2.3.), from the highest landings in the period between 1982 to 1994 of 12.4 t, to landings in 1996 of 546 t. Managers did not reopen the 1997 fishery in this area until a fishery independent survey had been carried out in April

1997. A subsequent survey was conducted in November 1997 (see later stock assessment section).

Industry advised that Queen Charlotte Strait had barely been fished to date, with the majority of fishing south of Malcolm Island and the inlets. The fleet initially moved into Area 12 when the west coast of Vancouver Island closed because it was an easy area to fish and a new processing plant opened.

Industry did not want to split the area up but requested separate catch ceilings by species. Most fishermen don't change gear when they target different species, but rather change to other fishing locations. The issue of how to manage a mixed species fishery was raised.

A survey was carried out in April 1997 in Subareas 12-26, 12-39, 12-40 and 12-42. (Table 4.2.9). The fishery was opened, April 21, pending results of the survey. Quotas were announced August 8 (see Table 4.2.6).

The area that was not surveyed, 12-outside (subareas 1-21, 24 and 15) was allocated a 10 t precautionary catch ceiling and that was surpassed by the August 19 closure.

The 12-Inside area was closed October 2, 1997 (Table 4.2.7) when the sidestripe allocation had been reached although only 73% of the pink-coonstripe allocation had been attained.

In November 1997, a re-survey of the 12-Inside area was conducted to compare stock biomass indices against the April survey values. A second survey during the same time period focused on sidestripes in the of Area 12-outside (Table 4.2.9; survey results) and a second opening for "12OUT" was set at Dec. 17, 1997 for 20,000 lb. (9 t) sidestripes and incidental pinks, accounting for landings in the earlier fishery.

Areas 13, 15 and 16 (GSTE)

The recommendation was to group these areas together as inshore areas. The initial DFO recommendation for area 15 was 80 t based on historic average catch. Fishermen felt there was more potential and requested 200 t. Fishermen harvest primarily a Strait of Georgia fishery, and although there are stocks in Bute (Area 13) and Jervis Inlets (Area 16), they are not exploited because they are currently remote. To date fishermen have been comfortably able to fish the same tows all year and haven't had to look further. Apparently there is much unreported catch. For example, fishermen allege that one company bought more in 1996 from Area 15 than is reported on fish slips or logs.

The Areas 13, 15, and 16 were grouped as Georgia Strait East (GSTE) with a precautionary quota of 220,460 lb. (100 t). This was based on a sum of the average historical landings for these areas (Table 4.2.2; 4.2.3). Prior to 1992, little catch was taken from Area 15, with a range from 0 to 14 t. However, between 1992 and 1996, the range of landed catch was from 32 to 69 t (Table 4.2.3).

Area 14

Industry commented that the whole area is not accessible to the fishery because of weather in some of the exposed portions. The main fishing ground historically has been from Hornby Is. to Little River, with the rest of the area relatively unexplored. Industry suggests poor markets rather than availability of shrimp, has limited the fishery. Much of the reported catch was sidestripe shrimp for the local market. Apparently catch is grossly under-reported. Harvest log data shows average CPUE is at an all time low - fishermen say many new fishermen in 1996 may skew the data. Industry suggested monitoring the "pinhead" fishing. DFO recommended a 50 t catch ceiling based on historic reported landings. Industry recommended 200 t as

reasonable. There were no dramatic increases in reported landings in Area 14 in the 1995/1996 period compared with historical levels.

The catch ceiling was set at 100 t.

Area 17

The catch ceiling set by DFO was 17 t, the 10th percentile, based on recorded catch since 1951. This fishery is based on mixed species and logbooks show a poor annual CPUE index. Fishermen commented that 17 t would be adequate for 4 boats but not enough if new vessels move in.

Area 18 and Area 19

These two areas have primarily sustained a coonstripe (*P. danae*) and sidestripe fishery with no catch of pinks recorded on logs, as there was little market for pinks until 1996. These areas produced a uniform high quality product. Primarily a winter fishery, September through May, with too much kelp present in the summer months, vessels traditionally either went salmon fishing or moved to trawl the west coast. Coonstripes occur in different areas than pinks or sidestripes so could potentially be managed separately. Fishermen stated that a 60 t catch ceiling set in April would be caught as pink shrimp in just a few days. The initial DFO recommendation was 40 t (60 t including area 20). Industry recommended 200 t pinks and 20 t coonstripes.

The ceiling for Area 18 was set at 100 t and Area 19 was limited to 20 t.

Area 28-29 (FR: see below, next section)

Area 20

Largely an Area with a trap fishery for coonstripe shrimp, *P. danae*, with little reported trawl activity to date. DFO set a 10 t precautionary catch ceiling.

Area 23 (23IN)

Area 23 was divided into inshore areas and offshore areas. Correct Subarea reporting on logs is difficult for fishermen. Resident shrimp stock at "the wall" in Subareas 23-5 and 23-6 is reported as noticeable to fishermen. After much discussion with fishermen, it was recommended that a separate catch ceiling be set for Subareas 23-1 to 23-6. Fishermen recommended 500 to 750 t as reasonable, however there was much discussion about the placement of the boundary making crowded fishing conditions. DFO initial recommendation was 50 t.

Fishermen estimate that 4 million lb. (1800 t) of shrimp was caught "inside" Barkley Sound in 1996. One vessel alone landed 100 t from the inside area. Fishermen estimated that 20 vessels fished in Imperial Eagle Channel. Louden Channel was a new, very 'hot', fishing area in the last couple of years. Concern was expressed about movement into other areas as catch ceilings are reached and areas closed, especially from the small boat fleet not equipped to move to offshore areas to fish. Fishermen agreed, after some discussions, that the inshore boundary was acceptable and that 23-7 to 23-11 should remain as part of the west coast offshore area.

A precautionary catch ceiling of 175 t was set for 1997/98 for Area 23 Inside: Subareas 23-1 to 23-6.

Area 24 (24IN); Area 25 (25 IN); Area 26 (26IN)

A separate precautionary catch ceiling of 10 t was set for each of these inshore Subareas.

Area 27/127 (27IN, 27OFF)

Quatsino 'inside' and 'offshore' were discussed as being quite different types of areas. Industry recommended a precautionary inside catch ceiling of 500 t. It was proposed to identify sidestripe areas through fishing activities, then to monitor effort and implement Subarea closures in-season, if required.

A precautionary catch ceiling of 10 t was set by DFO for the inshore Subareas 27-3, 27-7 to 27-11, with a separate catch ceiling of 50 t for offshore areas 127, 27-1, 27-2, 27-4 to 27-6, based on historical landings. The fish slip database for Area 27 included both the offshore 127 and inshore 27 (Table 4.2.3).

Offshore areas 121 (21 Off), 123, 23-7 to 23-11 (23 Off), 124, 125, and 126, 124Off, 125Off, 126Off)

A catch ceiling was not initially set by DFO, for the 1997/98 season, pending a PSARC review in July (see Stock Assessment section, 4.2.8). Following the PSARC review, a precautionary closure was put in effect, October 15,1997, to protect spawning stocks for the balance of the season. Industry advised against a closure but did not support a re-survey of the area.

4.2.5.5 Fraser River Division Catch Ceilings

In 1994, the total reported catch for Areas 28 and 29 declined to 69 t, down 50% from 1992 and 1993. Prior to 1996, this area represented approximately 50% of the East Coast of Vancouver Island and mainland fisheries (Table 4.2.3).

Area 28 and 29 (FR)

Concern was expressed by Joyce and Boutillier (1996) because of the presence of primary females in the sidestripe populations of the Fraser River area. Generally a conservative quota was supported for this area, with the collection of more biological data.

Some industry comments were that in 1996, shrimp were larger, that a closure should be implemented in March through April for egg bearing shrimp and in areas where pinheads are present. Small sidestripes are traditionally sold as pinks. In the past, fishing effort would decline when meat recovery rate declined (as egg bearing increased). Fishing pressure increased in 1996 largely due to a poor salmon season.

A catch ceiling was set at 90 t. The 10th percentile of historical landings for the last 10 years was 74 t and over the entire history of the fishery was 92 t.

4.2.6 Bycatch In The Shrimp Trawl Fishery

A student collected initial bycatch data from vessels in the shrimp trawl fishery in the summer of 1996. A bycatch subcommittee was formed from the Shrimp Trawl Sectoral Subcommittee in 1996 and a program of at-sea observers developed for the 1997/98 shrimp trawl season. The catch composition and preliminary estimates of bycatch, with emphasis on eulachons are presented in Hay et al. (PSARC I98-8). In summary, preliminary estimates of the overall bycatch by weight was 21% overall; 29 % for beam trawlers sampled (154 tows) and 19% for otter trawls sampled (390 tows). The bycatch of eulachons was identified as a concern, particularly in Queen Charlotte Sound and off the west coast of Vancouver Island.

The bycatch subcommittee met on several occasions over the season to review preliminary results. The B.C. Beam Trawlers Association held a workshop on net design and bycatch issues in March 1997.

The major bycatch strategies in order of priority (Pingguo He, personal communication, Sr. Researcher, Fishing Gear/Fish Behaviour; Fisheries and Marine Institute of Memorial University, St. John's, Nfld.) are:

1. Avoid
2. Exclude
3. Escape
4. Release

Several recommendations or issues were developed at the bycatch subcommittee meetings in December 1997:

1. Review and analyze bycatch data for January PSARC paper to identify components of the bycatch, including gear types, areas, times and species composition of bycatch.
2. Consider charters and test fishing in Queen Charlotte Sound, Jan.-April, prior to opening a commercial fishery. Funding would have to come from industry.
3. Consider charters/test fishing at the start of season for timing or area avoidance prior to opening the commercial fishery.
4. Consider new licence conditions describing gear specifications and restrictions to exclude bycatch.
5. 1998/99 season -set Eulachon "action levels" for area closures:
   maximum kg eulachons/tow
   maximum kg eulachons/day and a
   maximum kg of eulachons/season- quantity vs. rates
6. Experimental studies to avoid eulachons- will sound scare away fish? Consider the use of low rise nets or other net modifications may reduce eulachon bycatch.
7. Continue and increase biological sampling: stock identification, length-weight-ages, which may assist in the identification of eulachon stocks; DNA or elemental markers for stock identification.
8. Directed eulachon assessments and studies are required.
9. A Workshop is required, including First Nations, commercial eulachon fishermen, recreational fishermen and commercial shrimpers, forest industry, public and environmental watch.

There have only been two seasons of bycatch monitoring, the sampling carried out by a summer student in 1996, and programs carried out by DFO and a contractor in 1997/98. The shrimp effort and landings were significantly less in some areas such as the west coast of Vancouver Island in 1997/98. The estimates of bycatch may have been significantly different in years when effort and shrimp landings were greater.

4.2.7 Multi-Species Management

Historically shrimp have not been separated by species on the fish slips and log books and many fishermen sorted by size rather than species. For example, a market sample in 1997 of "pink" shrimp contained 20% small sidestripe shrimp (sampling Fish Management, South Coast). In historical data, many fishermen in the north called *P. hypsinotus*, "coonstripe shrimp", rather than "humpback", while fishermen in the south landed *P. danae* as "coonstripe" shrimp.

Efforts to improve catch data in 1997/98 include:

1. a new logbook format and a color species identification insert in each logbook

2. a new catch reporting form by species
3. sampling of catches on-board shrimp trawl vessels
4. sampling of catches at fish plants

Fishermen have been looking at sorting pinks by uniform sizes for higher value and larger species for freezing at sea. A recent development in the fishery has been in value-added products. The two species which have received the most attention have been the sidestripe and coonstripe shrimp. Some vessel operators interested in delivering a high-value sidestripe product to the Asian market have inserted exclusion devices and increased mesh size in their codends to reduce quantities of small shrimp. Product treatment includes boxing and freezing the shrimp. In 1996, values ranged from $0.50/lb (same as pink shrimp) to $10.00/lb. The least preferred fishing time is in summer months because the smaller size and soft-shell condition of the shrimp tends to reduce value. The high-value coonstripe fishery is based on delivering a live product to local markets in Victoria and Vancouver. Extreme care is taken with these shrimp to keep them alive. Value can be in excess of $5.00/lb. The fishery takes place primarily in the lower Strait of Georgia in the winter months when these shrimp appear to be abundant.

There is interest within both the shrimp trap and shrimp trawl fleet to expand the exploitation of humpback shrimp. Currently, the Departmental policy is that "any directed fishery for humpback shrimp in non-traditional areas or with new or modified trawl or trap gear will be subject to the Pacific Region Guidelines on New and Developing Invertebrate Fisheries" (letter from Mifflin, F.; Jan. 31, 1997).

4.2.7.1 Area Catch Ceilings and Quotas for Multiple Species

Some areas have quotas or catch ceilings for more than one species (see Table 4.2.7); Prince Rupert (pinks/sidestripes); Area 12 (pinks, coonstripes, sidestripes, humpbacks). The Area 19 catch ceiling was separated from Area 18 to allow for a coonstripe fishery, but no species limits were set.

Area 12-inside was closed based on the first species quota taken, when the sidestripe quota was taken (Table 4.2.7). A market sample of 'pink' shrimp landings just prior to the 12IN closure had a 20% sidestripe composition. The sidestripes were not readily distinguishable from the pinks in the catch on the basis of size. Thus the pink-coonstripe or humpback allocation could not be reached without the possible bycatch of sidestripes, threatening the sidestripe stock.

4.2.8 Stock Assessment Programs

This section identifies the stock assessment and research activities that were carried out in the 1996 and 1997 calendar years. Stock assessment activities were conducted under the Crustacean Fisheries Assessment and Data Management Program within the DFO, Science Branch, Stock Assessment Division, Shellfish Section. There were three main objectives set for 1997/98.

a) Conducted fishery independent surveys of the offshore shrimp stocks. A survey of the west coast of Vancouver Island areas 121, 123, 124 and 125 and portions of areas in and adjacent to Queen Charlotte Sound (e.g. Goose Island Gully, Pearl Rocks, Queens Sound, Queen Charlotte Straits etc.) were completed in May 1996 and 1997 (Table 4.2.8.).

b) Conducted fishery independent surveys of the Area 12 inshore and nearshore shrimp stocks. Two surveys were conducted in with the industry participation. The first survey was a pre-fishery survey in April 1997 conducted in Pacific Fisheries Management (PFM)

Areas 12-26, 12-39, 12-40, and 12-42. The second survey was a post-fishery survey in November 1997 and was conducted in PFM Areas 12-07, 12-26, 12-40, and 12-42. The results of the survey were given to managers and resulted in a reopening of the nearshore areas (Table 4.2.8).

c) Provided sample processing and analysis of biological samples obtained by the observer program, by patrol and charter vessels from shrimp trawl fisheries.

d) Collected, corrected and compiled logbook and fishery independent data on shrimp trawl fisheries. In 1997 a new logbook program was developed which incorporated more specific georeferenced trawl locations and species identification.

e) An assessment of the Inshore Shrimp Fisheries: Data Status, Model Requirements, Problems was completed for PSARC I96-11.

f) Detailed analyses of stock-recruit dynamics and the extent of environmental affects were conducted in 1997 and summarized in Boutillier et al. (1997).

4.2.9 Enforcement Concerns

There were increased boardings of the inshore shrimp trawl fleet by Fishery Officers in 1997 compared with past years.

Efforts are being made to increase the current level of C&P representation at Shellfish Advisory groups (Prawns, Shrimp Trawl, Geoduck, Clams, and Sea Urchins).

The management plan for this fishery is becoming extremely complex and most Fishery Officers are not fully aware of all the management measures in this fishery. It is recommended that Fisheries Management and C&P implement a familiarization program for Fishery Officers so that they clearly understand all aspects of each year's management plan.

A new Departmental Violation System/ Fishery Officer Reporting systems should improve access to enforcement data for shellfish fisheries.

The bycatch of non-target species i.e. flounder, rockfish, sole, and swimming scallops appears to be high based on reports by Fisheries Officers. The use of separator grates is recommended to reduce the bycatch of non-target species.

Enforcement staff consider bycatch of prawns to be a serious concern in this fishery during non-retention periods for the following reasons: some fishermen are targeting prawns under the guise of a shrimp trawl fishery, and the 5-lb. by-catch limit of prawns is not readily enforceable. The use of selective closures in known prawn poaching areas should be explored, and consideration should be given to set bycatch allowances by piece, not by weight, to improve enforcement.

4.2.10 Landings in the 1997/98 fishery

In 1997, changes were implemented in all aspects of shrimp trawl databases; logbooks, fish slips, and landing records. Landings in 1997 (Tables 4.2.1, 4.2.7, Figure 2) are down from 1995 and 1996. Much of this is due to the lower stocks off the west coast of Vancouver Island, precautionary catch ceilings, and lower shrimp prices in 1997.

Logbooks had new fields for detailed georeferencing information, and the timing of submission was changed from 28 days following landing to 7 days following landing. It was hoped that more complete data and more timely submission of logbook data would enable Stock Assessment to use this data in-season for management and stock assessment, including survey design.

The fish slip database for all commercial shellfish including shrimp was changed in 1997 with the consequence that catch by area information for the 1997 year is not available. Preliminary coastwide catch summaries are available by vessel or by month, with incomplete and unreliable estimates of catch by area, days fished or value data.

A landing record database was developed by DFO and a contractor to the Pacific Coast Shrimper's Cooperative Association, for in-season management purposes. This database contains records starting in June 1997, when the new management plan was released. Since its purpose was primarily for in-season management, landings were assigned to "SMA"s, or Shrimp Management Areas in order to monitor catch ceilings, rather than the traditional Fisheries Management Areas.

The changes to the timeliness of logbook submission and the creation of a landing record database provide the only landing information available (at January, 1998) by Area for the 1997 period. Unfortunately, since the most complete database is the landing record database, and it is not organized by statistical area, the results for 1997 must be presented in a different format from previous years.

4.2.11 Priority Issues in the Shrimp Trawl Fishery

1. SEPARATION OF TRAWL GEARS. There are two major gear types of shrimp trawl: beam trawls and otter trawls. It has been recommended that these gear types be separated in the close time schedules to allow for selective gear management in areas. Gear restrictions by area could also be effected by conditions of licence. Many jurisdictions, Alaska and Washington, for example, consider the different gear types in the management of the shrimp fisheries.

2. DELAY THE OPENING OF THE FISHERY IN INSHORE AREAS OR COASTWIDE, OR HAVE QUARTERLY OR OTHER PERIODS OF CATCH CEILINGS. Science has advised that larger shrimp would be taken and significant increases in weight could be achieved if the fisheries were delayed to July. This larger shrimp may also have a higher value.

Industry has consistently requested early openings, in April, to set the prices for the season.

Various options, e.g. May/June closures should be considered or closures for the lower volume inshore fisheries in April/May/June.

Observers / port samplers should monitor the percentages of egg bearing females in the catches. Surveys in April 1997 found some species in some locations had high percentages of egg-bearing females (J. Boutillier, pers. comm.).

3. AREA CATCH CEILINGS FOR MULTIPLE SPECIES. The fishery targets on different species; high volume pink fisheries and smaller volume, higher valued fisheries for sidestripes, humpbacks, and coonstripes. This creates management problems for a mixed species fishery in an area.

4. NEW FISHING AND HANDLING PRACTICES. These are being developed to sort and freeze larger shrimp for higher values. Larger mesh nets may have to be set as a condition of licence to avoid the discarding of smaller shrimp or smaller species. This needs to be evaluated in the observer program.

5. BYCATCH IN NEWLY EXPLORED AREAS. It appears that in new grounds, or in areas where shrimp abundance is low, bycatch may be high.

6. REVIEW OF THE 10 TONNE PRECAUTIONARY CATCH CEILINGS. These were set for many areas (see Table 4.2.7). An analysis of log records is required to evaluate the extent of

the area fished, vessel CPUE and other data. In 1998/99, vessels fishing these exploratory areas should have observers and biological samples should be taken. Some areas were not fished at all.

7. CATCH MONITORING PROGRAM. This program has not yet been evaluated with respect to dockside verifications compared with landed values. To date, it appears that the program has enabled managers to enact timely closures of areas when catch ceilings or quotas were landed.

8. BYCATCH OBSERVERS. This program has not yet been evaluated as to whether it met the coverage required by DFO. There were numerous problems with the deployment of observers particularly in North Coast and Fraser River divisions. Fishermen in many areas did not cooperate in taking out observers when requested. Estimates of bycatch in many areas over the season were provided.

9. HISTORICAL DATABASES. Creation of new licence year and creation of new SMA's complicates historical catch reporting database.

10. SURVEY PROTOCOLS. Area-swept trawl and vertical trap surveys in Area 12 were conducted in 1997 to set quotas. It is not clear what the process of setting the 1998/99 quotas will be. A process needs to be developed for areas where surveys are conducted to determine how frequently surveys must be carried out. Further data analyses of the 1997 surveys may be required or a new survey to be scheduled or completed for Area 12, prior to opening the area for a limited amount of quota while the survey results are completed.

Interim survey reports, requested by managers and industry for the April and November surveys in Area 12, are in preparation for May 1998.

11. WCVI SURVEY. The survey area on WCVI needs to be expanded into Barkley Sound. *The fishery is scheduled to open April 1, 1998.* A survey is planned for May 1998. Landings from April 1, 1998 will be taken into account if subsequent quotas are set based on survey results.

12. SORTERS AND GRADERS; ON DECK HANDLING AND PROCESSING EQUIPMENT. Shrimp counts or size limits may be considered. This type of equipment should be evaluated and it should be accompanied with net modifications. The dumping of shrimp is prohibited.

13. NEW AND DEVELOPING FISHERIES. There is interest within both the shrimp trap and shrimp trawl fleet to expand the exploitation of humpback shrimp. Currently, the Departmental policy is that "any directed fishery for humpback shrimp in non-traditional areas or with new or modified trawl or trap gear will be subject to the Pacific Region Guidelines on New and Developing Invertebrate Fisheries" (letter from Mifflin, F.; Jan.31,1997)

14. LOCAL AREA OVERFISHING. Fishermen complain that certain tow locations in Area 28-29, Area 19, are repeatedly fished and depleted. This is a consequence of shifting effort from boats when adjacent areas are closed when catch ceilings are reached.

15. PRAWN BYCATCH LIMITS. Fishery officers have requested that the 5 lb. prawn bycatch possession limit be changed to a piece count.

16. ECONOMIC STUDY. Many fishermen have requested that the department undertake an economic survey, including the new management and assessment costs. A survey was attempted by industry in 1997, but did not receive a significant response.

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Table 4.2.1. Shrimp landings (tonnes) by trawl, effort and value from sales slips, 1982 to 1996 and a preliminary summary of 1997 landings for January to March (1997a), prior to catch ceilings, and April to December (1997b), subsequent to catch ceilings.

Year	Number of Eligible Licences	Number of Vessels with Landings	Fishing Effort (days)	Shrimp Landings (tonnes)	Total Landed Value ('000's $)	Whole Landed Value ($/kg)	$\bar{X}$ CPUE[a] (tonnes/day)
1982	249	N/A	4,230	398	863	2.17	0.09
1983	249	120	8,076	411	1,095	2.66	0.05
1984	249	114	6,783	408	1,022	2.50	0.06
1985	249	102	6,337	678	1,180	1.74	0.11
1986	249	102	5,580	768	1,240	1.61	0.14
1987	249	165	9,027	2,643	4,609	1.74	0.29
1988	249	190	6,763	2,561	3,248	1.27	0.38
1989	249	174	6,982	2,299	2,838	1.23	0.33
1990	249	173	6,360	1,940	2,637	1.36	0.30
1991	249	185	7,564	3,265	4,430	1.36	0.43
1992	249	162	6,123	2,683	3,499	1.30	0.44
1993	249	158	6,139	3,283	3,499	1.07	0.53
1994	249	165	7,311	3,192	4,776	1.50	0.44
1995	249	216	14,331	6,778	13,663	2.02	0.47
1996	249	222	16,246	7,386	11,001	1.49	0.45
1997a	248	89	N/A	257	N/A	N/A	N/A
1997b	248	180	N/A	2,849	N/A	N/A	N/A

Table 4.2.2. Annual shrimp landings (tonnes), by trawl gear, for North Coast Management Areas, 1982 to 1996 (as reported on sales slips).

	NORTH COAST MANAGEMENT AREA										
Year	1	2	3	4	5	6	7	8	9	10	Annual Landings
1982	2.6	0.0	1.4	20.3	0.4	0.0	0.0	0.0	0.3	0.0	25.0
1983	1.9	0.7	1.7	11.4	2.1	1.2	0.0	0.0	0.7	0.0	19.7
1984	5.7	0.5	0.8	8.8	8.5	4.7	0.6	1.8	0.0	0.0	31.5
1985	3.0	0.5	2.5	15.8	11.9	0.5	0.0	0.0	0.0	0.0	34.3
1986	0.8	1.4	4.2	27.3	11.3	0.8	0.9	1.3	1.1	0.0	49.0
1987	5.9	1.7	2.6	19.7	6.9	7.6	0.1	1.1	1.0	0.1	46.8
1988	1.0	3.1	3.2	10.9	7.3	1.9	0.3	0.6	1.1	1.7	31.1
1989	3.0	1.4	0.6	29.7	5.2	3.7	2.5	6.4	3.7	7.3	63.5
1990	2.5	0.6	4.0	91.2	8.2	24.2	0.5	1.2	0.1	0.3	132.6
1991	3.6	7.7	2.4	75.8	7.4	6.0	0.7	0.8	2.2	2.6	109.2
1992	2.5	0.5	3.2	52.8	12.5	0.6	3.5	4.2	3.7	7.9	91.3
1993	2.9	0.3	8.2	46.9	7.3	1.7	2.1	3.1	0.2	4.5	77.3
1994	0.0	0.5	0.1	61.1	5.2	6.2	0.7	0.3	3.3	0.0	77.5
Average 1982-1994	2.7	1.5	2.7	36.3	7.3	4.5	0.9	1.6	1.3	1.9	60.7
1995	0.8	4.8	6.3	163.9	16.2	23.0	0.8	11.8	9.7	2.1	239.3
1996	8.7	0.7	14.4	476.5	32.8	13.2	247.9	908.7	11.9	31.8	1,746.5 *

* In 1996, North Coast landings accounted for 24% of the coastwide landings.

Table 4.2.3. Annual shrimp landings (tonnes) by South Coast Management Areas 1982 to 1996, as reported on sales slips.

	SOUTH COAST MANAGEMENT AREAS											
	East Coast Vancouver Island											
Year	11	12	13	14	15	16	17	18	19	28	29	East Coast Landings (t)
1982	-	0.4	-	18.8	-	6.4	20.5	6.1	0.1	53.6	90.6	196.5
1983	0.6	1.7	0.1	26.2	0.0	13.3	70.3	13.1	0.0	28.1	171.5	324.8
1984	-	1.5	0.6	27.7	0.0	1.3	90.2	4.6	0.7	80.3	120.1	327.0
1985	-	2.0	0.4	32.6	0.2	1.2	60.4	5.3	0.8	60.7	92.9	256.5
1986	0.1	12.3	3.1	39.7	2.4	4.0	42.1	4.2	1.4	74.8	51.7	235.9
1987	1.1	6.0	1.2	38.5	1.2	7.7	23.7	12.7	1.4	83.5	78.3	255.4
1988	-	6.2	0.4	49.6	1.9	0.3	33.1	8.1	3.2	53.6	114.3	270.9
1989	0.4	3.0	1.3	35.5	13.9	1.7	36.0	8.5	4.5	42.2	91.2	238.1
1990	0.2	12.0	1.9	51.7	1.2	2.7	15.2	4.5	0.8	13.9	61.4	165.6
1991	0.1	12.4	-	77.4	2.3	0.8	37.0	10.9	0.4	54.6	67.0	262.8
1992	0.2	1.6	24.3	109.7	46.2	0.8	39.4	7.4	0.6	50.5	91.1	371.8
1993	0.1	2.7	1.1	118.4	42.9	1.5	22.9	5.3	0.1	57.3	86.7	338.9
1994[1]	0.2	0.8	2.4	78.0	65.7	2.2	15.4	2.5	0.1	24.4	43.4	235.0
Average 1982-1994	0.2	4.8	2.8	54.1	13.7	3.4	38.9	7.2	1.1	52.1	89.2	267.6
1995	16.5	67.3	12.3	34.2	32.2	1.9	17.4	14.5	1.7	55.1	90.8	344.0
1996	55.3	545.8	2.3	120.2	69.3	16.0	23.8	195.8	23.1	64.9	133.8	1,250.3

	West Coast Vancouver Island (WCVI)								Total Landings (t)	
Year	20	21	22	23	24	25	26	27	WCVI	Sout Coast
1982	0.5	-	-	34.5	123.0	-	-	-	158.0	354.5
1983	17.2	10.9	-	36.7	1.8	-	-	-	66.7	391.5
1984	7.0	-	-	40.9	1.0	0.9	-	-	49.7	376.8
1985	4.8	3.3	-	304.8	73.1	0.8	-	0.6	387.5	644.0
1986	3.7	-	-	288.5	190.4	0.0	-	0.7	483.3	719.2
1987	6.4	-	-	281.3	2,049.6	1.8	1.2	0.5	2,340.8	2,596.2
1988	4.7	-	-	276.9	1,972.0	2.3	-	3.0	2,258.8	2,529.7
1989	13.1	-	-	310.1	1,660.4	8.9	0.4	4.2	1,997.1	2,235.2
1990	4.8	0.1	-	302.1	1,330.2	4.1	-	0.0	1,641.4	1,807.0
1991	9.5	-	-	989.9	1,658.8	204.2	-	30.3	2,892.5	3,155.3
1992	2.6	0.0	-	145.5	1,009.5	989.9	4.9	67.1	2,219.6	2,591.4
1993	2.3	-	-	308.8	895.9	1,650.9	6.8	1.7	2,866.4	3,205.4
1994(1)	5.8	3.8	-	528.9	1,424.3	911.9	3.4	0.9	2,879.0	3,114.1
Average 1982-1994	6.3	1.4	-	296.1	953.1	290.4	1.3	8.4	1,557.0	1,824.6
1995	8.5	84.9	-	3,818.7	1,409.4	823.7	12.1	37.1	6,194.4	6,538.4
1996	-	51.3	-	3,206.7	529.2	476.4	7.3	118.0	4,389.0	5,639.2

Notes: 1. Areas 28 & 29, 1994 catches have been corrected to reflect catch by area based on logbook data.

Table 4.2.4 . Summary of preliminary shrimp trawl landings (tonnes) by North Coast Management Areas and month in 1996, as reported on sales slips.

	NORTH COAST MANAGEMENT AREAS												
Month	1	2E	2W	3	4	5	6	7	8	9	10	NORTH COAST	SOUTH COAST
Jan					13.4	1.3						14.7	70.1
Feb					68.1	1.0						69.1	114.3
Mar		0.10	0.07	0.09	141.5	3.9				0.3	1.4	147.4	112.5
Apr				0.30	118.6	9.6	5.1		8.1	4.1	2.8	148.5	406.9
May	0.22			1.29	60.4	4.0	1.5		15.4	1.6		84.5	842.8
June					11.2	1.0		0.3	86.4	0.5		99.5	1,067.0
July				2.46	8.7			1.5	223.9	0.0		236.5	1,138.9
Aug				1.15	5.5	0.9		4.0	327.0	0.9	6.7	346.0	675.1
Sept				2.35	23.4	2.0		130.0	210.7	1.3	1.3	371.0	629.0
Oct	8.44			2.67	15.6	3.4		104.6	35.4	1.0	18.3	189.3	387.2
Nov		0.07	0.12	2.22	5.0	4.2	4.4	0.9	2.0	2.3	0.9	22.2	148.1
Dec			0.33	1.82	5.2	1.4	2.1	6.6			0.5	18.0	47.2
Area Totals	8.7	0.2	0.5	14.35	476.5	32.8	13.2	247.9	908.7	11.9	31.8	1746	5839

Table 4.2.5 . Summary of preliminary shrimp trawl landings (tonnes) by South Coast Management Areas and month in 1996, as reported on sales slips.

	SOUTH COAST MANAGEMENT AREAS														
	East Coast Vancouver Island											West Coast Van			
Month	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24
Jan		14.7		6.5	4.3	0.9	2.1	0.7		6.3	10.4			6.5	
Feb		38.2		3.4	3.8	1.3	1.8	0.9		9.0	14.0			14.7	
Mar		36.9		2.7	1.4	0.3	2.3	7.1		3.8	15.9			13.5	
Apr	1.4	18.5	0.5	7.8	1.1	0.8	3.0	46.7		5.9	18.2		15.7	240.0	15.1
May	3.1	15.9	0.8	12.5	7.3	3.8	2.2	44.6		2.9	10.0		22.7	443.2	66.6
June	3.6	61.6	0.3	9.2	7.1	2.4	0.8	12.4	4.4	4.7	9.3		9.6	616.6	112.6
July	21.3	113.7		13.1	8.9	1.7	0.3	21.6	1.4	6.1	8.7			750.5	153.0
Aug	25.2	66.3		9.5	13.2	1.5	0.1	7.3		3.8	7.3		3.3	428.2	93.7
Sept	0.6	80.9		15.2	10.6	1.2	1.5	11.7		8.4	11.8			399.0	84.3
Oct		74.0	0.7	25.8	6.3	1.6	5.1	21.2	3.6	9.4	11.9			223.0	3.8
Nov	0.1	9.7		11.7	3.6	0.4	3.1	13.0	7.5	3.2	8.3			69.9	
Dec		15.4		2.9	1.7	0.1	1.5	8.5	6.2	1.4	7.9			1.6	
Area Totals	55.3	545.7	2.3	120.2	69.3	16.0	23.8	195.8	23.1	64.9	133.8		51.3	3,206.7	529.2

Table. 4.2.6. History of management actions in the shrimp trawl fishery.

Year	Management Action

1376 - the first complaints about beam trawls and bycatch, England (W. L. Scofield, 1948)

"Some arrangement of beam and bag net, essentially a trawl, was used in England, causing complaint to Parliament in 1376 that certain fishermen had subtly devised a contrivance to which was attached a net of so small a mesh that no manner of fish could escape and such practice was to the great damage and destruction of the fisheries of the Kingdom".

1895- earliest records of trawling for shrimp in B.C.

1930's-1940's A seasonal closure to shrimp was in effect in upper Burrard Inlet, Dec. 1-Mar. 31, the main egg bearing period for "coonstripe" or "dock shrimp" (*Pandalus danae*).

This fishery collapsed due to overfishing or to pollution from oil refineries in the area or a combination of both. The only shrimp closure on the coast apparently has had little effect. (T. Butler, memo Feb. 1975).

1948? - Shrimp cannery at Bones Bay, New England Fish (CanFisCo)- a number of small beam trawl vessels fished in Cleo Channel and surrounding areas. Deep Bay- there was a fleet of beam trawl vessels and a shrimp cannery.

1950's, 1960's: Fisheries Research Board (FRB) developed information on fishing grounds:

- Nootka Grounds discovered in 1955, later fished in 1973
-Quatsino grounds discovered in 1954

1957- Seattle was the first site of a mechanical peeler on the Pacific coast, leading to rapid demand and increases in landings from California to Alaska.

1964- Territorial Sea and Fishing Zones Act: 9 mile fishing zone outside the three mile territorial limit; headland to headland baselines.

1967- All fishing within 3 mile limit; shrimp landings of 1,695,600 lb. (769 t) valued at $332k - 905 taken by trawls. Reports by Pacific Marine Fisheries Commission (PMFC) Shrimp fishing areas (Butler 1969)

1972- Fisheries Industrial Development Branch chartered M.V. Pacific Trident for exploratory shrimp trawling on the West Coast Vancouver Island (WCVI).

1974- Total landings est. 3,056,911 lb. (1387 t) including landings from:

-six Washington shrimp vessels landed 456,500 lb. (207 t) from WCVI.

-Vessels from Oregon fished from April through October and landed in the Astoria, Oregon area 859,111 lb. (390 t).

-Canadian vessels landed 1,741,300 lb. (790 t) New shrimp peeler in Tofino with three vessels landing an estimated 1.5 million (680 t). Estimated to be 13 vessels equipped for shrimp trawling.

Table. 4.2.6. (Continued)

Year	Management Action

Concerned expressed about quality of shrimp north of Oregon due to microsporidian parasite that affects the appearance and odor of landed shrimp.

Maximum Standard Yield (MSY) est. to be 7 million lb.(3175 t) for WCVI.
Comments on exploratory fishing 1972-73
-tows in the Goose Island Gully-SSW Hakai Pass- 40 sq. mi.
-tows on Pearl Rocks- 10 to 12 sq. mi.
-est. 162 sq. mi. off Tofino as of May, 1973.

Due to falling prices for shrimp, the operation of both processing plants on the WCVI were in receivership until the future of the plants was determined (memo, June 12,1975)

1975- Landings on WCVI included:

-265,000 lb. US vessels + 1,100,000 Cdn = 1,365,000 lb.(619 t) reported

1976- Landings reached a high of 11,100,000 lb. (5035 t) ++

-3,600,000 lb. by US vessels and 7,500,000 lb. by Cdn vessels

Approx. 12 Canadian and 12 American shrimp trawlers fishing Tofino and, to a lesser extent, Nootka grounds. Canadian vessels delivering to Tofino and Ucluelet.

++ Canadian fishers report thast there were as many as 20 US vessels and the reported landings of 3.6 million lb. (1633 t) are low. Some of the catch delivered to plants in the US may not have been recorded as being landed from Canada.

1977 Surveys and assessments indicate annual limits of 5.7 million lb. (2586 t) for Tofino grounds and 2 million lb. (907 t) for Nootka grounds (this was less than the 11. 1 million lb. landed in 1976)

Feb. 9/77:

- **licence limitation** announced limiting participation in the shrimp fishery in 1977 to those vessels that recorded landings in 1975 and/or 1976 . This applied to all areas of the coast.

- **WCVI- closure** 6:00 pm June 30,1977 to midnight August 31,1977, *"fully supported by the Shrimp Producers Association of B.C."*.

-1.2 million lb. (544 t) (29%) was expected to be harvested on the WCVI by US vessels (US west coast landings at the time California and Oregon approx. 40 million lb.)

-**overcapitalization**: *"it has been brought to the attention of the Department that processors are expanding their capability to handle shrimp to a level far in excess of the harvest that can be permitted from the Tofino grounds"*.

In 1977, the Washington, Oregon, California fishery landings approached 200 million lb., (90700 t) with 250 boats and 750 men. However, Alaska landings plummeted from 51 to 31 million lb. (23130 t – 14060 t)

In the 1970's there were as many as 90 shrimp-peeler machines in Alaska.

Table. 4.2.6. (Continued)

Year	Management Action

1978- Two surveys by the Fisheries Research Board (FRB), M.V. G.B. Reed and one by commercial fishing vessel.

A TAC of 2 million lb. (907 t) was recommended for the Tofino grounds. Shrimp landings in June-July from the Tofino grounds were 200,000 lb. (91 t) compared to over 2 million lb. (907 t) in the same period in the year previous (1977).

An open fishery was allowed for the Nootka grounds "as a trial for alternate management strategy". Over 1.8 million lb. (816 t) were taken in June-July 1978.

The management policy was "to maintain an adequate brood stock of shrimp to produce an optimum yield from the available stock".

Canada extended its fishing zone to 200 mi. under Canada's Extension of fisheries Jurisdiction. US vessels had not fished the Nootka grounds because the grounds lied within Canada's 12- mile exclusive fishing zone.

1979- 237 'S' licences issued and 71 'Northern Area permits' (only 50% active in the fishery)

In 1979 there were a number of stock collapses, landings fell to a nine-year low of 98 million lb. (44450 t) but the number of vessels increased to 300.

1980- Publication of Butler's "Shrimps of the Pacific Coast of Canada."

1981- WCVI **TAC recommended for Tofino grounds was 200 t.** The quota was taken and the area closed to fishing until another TAC was set in May, 1982 (Bernard, 1982).

TAC for Nootka grounds was 520 t, open to fishing until the quota was reached or April 30, 1982 (Bernard, 1982)

1982- 249 'S' licences issued.

Permit fishery for Trevor Channel, Barkley sound, considered underutilized; precautionary quota recommended 113 t, April 1, 1982 to March 31, 1983; logbooks required.

Report by Pearse Commission on Pacific Policy, stated that the first obligation of the federal government is to ensure conservation of the resource.

1984- Report on 1982-83 logbook and catch sampling in Barkley Sound (Boutillier and Harling in Jamieson 1985)

1985- WCVI - 21 vessels reported landings of 192 t.

1986- Report on surveys- biomass and area fro Tofino and Nootka grounds- 1973 to 1985 (Boutillier in Harbo and Jamieson, 1987).

247 'S' licences; **five scientific permits were issued for a portion of Barkley Sound. This lead to one licence being granted (1991) with restrictions on the Area of Fishery.**

Table. 4.2.6. (Continued)

Year	Management Action

1987- Mandatory harvest logs set as a condition of the shrimp licence.

1988- Dioxin closures.

1989- Year round fishery. **New management action to set Target Catch at 2268 t (5 million lb.) for offshore WCVI.**

1990- Assessment of Area 124, Tofino grounds: recommend a closure at the end of Oct. coincident with the end of the US fishery (Boutillier in Thomas 1990)

Year round fishery. Target catch set at 2268 t (5 million lb.) for offshore W.C.V.I.

Prawn by-catch restriction- 1% or 5 lb. whichever is greater, during open times for prawns.

1991- Assessment of Area 124, Tofino grounds: TAC recommended between 810 and 842 t (Boutillier in Thomas 1992)

Recommendation to delay Area 124 opening until mid-May or June to maximize yield per recruit. Year round fishery. Target catch set at 2268 t (5 million lb.) for offshore WCVI.

Prawn by-catch restriction 2% or 5 lb. whichever is greater, during open times for prawn retention. Three shrimp trawl permits (1 north, 2 in the south for Areas 17-18) were issued to allow for the retention of prawns to allow the fishers to seek alternate shrimp fisheries or appeal for a shrimp (prawn) trap licence. A restricted "S" licence was issued for beam trawling in Subareas of Area 23.

1992- Year round fishery. Target catch set at 2268 t (5 million lb.) for offshore W.C.V.I.

Prawn by-catch restriction- 2% or 5 lb. whichever is greater, during open times for prawns.

1993- Year round fishery. Target catch set at 2268 t (5 million lb.) for offshore W.C.V.I.

Prawn by-catch restriction- 2% or 5 lb. whichever is greater, during open times for prawns

By-catch limits set for squid at 2% of the shrimp weight.

1994- Preliminary review of logbook data for inshore shrimp fisheries. Prawn by-catch restriction 2% or 5 lb. whichever is greater, during open times for prawns. For vessels with both prawn trap, W and shrimp trawl S licences, prawns must be offloaded before fishing under the authority of the S licence.

1995- FRASER RIVER SOCKEYE PUBLIC REVIEW BOARD- Chaired by John Fraser-focused on salmon, but reinforced the need for "risk averse management" and called for greater attention to more precautionary management approaches for all west coast fisheries.

Significant increases in active licences (165 in 1994 to 222 in 1995); fishing days (7,311 in 1994 to 14,324 in 1995); total landings (3192 t in 1994 to 6777 t in 1995) and total value ($4.7 m in 1994 to $13.7 m in 1995). Prawn by-catch restriction 2% or 5 lb. whichever is greater, during open times for prawns. McIntyre Bay closed May 1 to Sept. 30 to reduce by-catch of halibut. First elected Shrimp Trawl Sectoral Committee established in September. Dioxin closures lifted for shrimp by trawl in all areas Feb. 10.

Table. 4.2.6. (Continued)

Year	Management Action
	International Code of Conduct for Responsible Fisheries adopted by FAO, United Nations, development of "Canadian Code of Conduct for Responsible Fishing Operations.
	1996- Closures on the WCVI: Subareas 23-6 to 23-11, 21, 121, 123, 124 were closed for the first time, effective Jan. 1,1996 to 08:00 April 1,1996. Prawn by-catch restriction 2% or 5 lb. whichever is greater, during open times for prawns. Non-retention of prawns in Area 17 (new in 95). Subareas 28-11 to 28-14 closed until evaluated. Area 1 and 101 closed year round due to concerns about halibut by-catch.
1997	
•	**January 1 to April 1- interim fishing plan** **Fishery closure Closures on the WCVI:** Subareas 23-6 to 23-11, 21, 121, 123, 124 were closed, effective Jan 1.1997 to 08:00 April 1,1997.
•	**April to June 1- interim fishing plan** Registration of the Pacific Coast Shrimpers' Cooperative Association (PCSCA) Designated service bureau established for monitoring and bycatch observers
•	**Area 12 survey- inside Subareas- April/97.** Fishery opened April 21,1997. TAC set August 8, reached by Oct. 2 closure. 12-outside area was assigned 10 t precautionary quota, closed Aug 19. Surveyed in November, reopened Dec. 19 for additional 20,000 lb. (9 t).
•	**June 18, 1997 / April 15 1998** New fishing plan with hail requirements, catch monitoring and bycatch monitoring programs. DFO Shrimp Trawl Fishery Manager, funded jointly by DFO and industry. New Shrimp Trawl Landing Records developed in conjunction with PCSCA and Archipelago Marine Research Ltd. (AMR). Revised Shrimp Trawl Fishing Logbook (J. O. Thomas)
•	Catch ceilings in effect to March 31, 1999; fishing plan in effect to April 15, 1998 with new catch ceilings to be announced for the period April 1, 1998 - March 31, 1999.
•	November 1997. New shrimp trawl sectoral committee selected by industry vote.
•	Dec. 4, 5, 1997. Meetings of bycatch subcommittee and Queen Charlotte Sound fishermen.

Table 4.2.7. 1997/98 Shrimp trawl catch ceilings, quotas, and opening and closure dates

Closed March 31, 1997 following the end of valid licence conditions.
OpenedApril 8, 1997 to June 1, 1997 with new catch ceilings in place while DFO negotiated with industry. All areas opened except Area 12, which opened on April 21, 1997 following a stock assessment survey.
Closed coastwide June 1, 1997 to June 17, 1997 while management plan and licence conditions finalized.
Opened Coastwide until catch ceilings attained (see below), catch ceilings for peiod April 1/97 to March 41/98.

SMA	Subareas	Catch Ceiling (Lbs)	Landings (Lbs)**	Opening Date With New Catch Ceilings*	Closure Date	Re-Opening Date
DXE	1, 101	22,050	0	Apr. 8, 1997		
QCI	2, 102, 142	22,050	471	Apr. 8, 1997		
3IN	3-5 to 3-16	22,050	38,742	Apr. 8, 1997	Sept. 18, 1997	
PRDpinks	3-1 to 3-4, 103, 4-1 to 4-16, 104, 5-1, 5-2, 5-23	220,460	79,256	Apr. 8, 1997		
PRDsides	3-1 to 3-4, 103, 4-1 to 4-16, 104, 5-1, 5-2, 5-23	220,460	96,301	Apr. 8, 1997		
5IN	5-3 to 5-10, 5-12 to 5-19, 5-21, 5-24	22,050	25,863	Apr. 8, 1997	Dec. 19, 1997	
5OFF	5-11, 5-20, 5-22, 105	22,050	0	Apr. 8, 1997		
6IN	6-1 to 6-8, 6-10 to 6-12, 6-14 to 6-16, 6-18 to 6-28	22,050	15,316	Apr. 8, 1997	Dec 12, 1997	
6OFF	6-9, 6-13, 6-17, 106	22,050	0	Apr. 8, 1997		
7IN	7-2 to 7-25, 7-27 to 7-30	22,050	3,688	Apr. 8, 1997		
8IN	8-2 to 8-16	22,050	3,002	Apr. 8, 1997		
9IN	9-1 to 9-12	22,050	25,274	Apr. 8, 1997	Sept. 9, 1997	
10IN	10-3 to 10-12	22,050	20,712	Apr. 8, 1997	Nov. 7, 1997	
11IN	11-3 to 11-10	22,050	7,500	Apr. 8, 1997		
QCSND	107, 7-1, 7-26, 7-31, 108, 8-1, 109, 110, 10-1, 10-2, 111, 11-1, 11-2, 130	1,322,750	1,336,856	Apr. 8, 1997	Sept. 19, 1997	
12INpinks	12-22, 12-23, 12-26 to 12-48	380,000	282,972	Apr. 21, 1997	Oct. 2, 1997	
12INsides	12-22, 12-23, 12-26 to 12-48	15,000	17,456	Apr. 21, 1997	Oct. 2, 1997	
12INhumps	12-22, 12-23, 12-26 to 12-48	35,000	9,577	Apr. 21, 1997	Oct. 2, 1997	
12OUT	12-1 to 12-21, 12-24 and 12-25	75,874***	56,150	Apr. 21, 1997	Aug. 19, 1997	Dec. 17, 1997
GSTE	13, 15, 16	220,560	201,851	Apr. 8, 1997	Jan. 4, 1998	Jan. 12, 1998
14	14	220,560	125,424	Apr. 8, 1997		
17	17	37,480	28,784	Apr. 8, 1997	Jan. 4, 1998	Jan. 12, 1998
18	18	220,560	178,752	Apr. 8, 1997		
19	19	44,090	60,715	Apr. 8, 1997	Nov. 16, 1997	
20	23-1 to 23-6	22,050	0	Apr. 8, 1997		
21OFF	21, 121	N/A	36,864	Apr. 8, 1997	Oct. 15, 1997	
23IN	23-1 to 23-6	385,800	384,389	Apr. 8, 1997	Nov. 23, 1997	
23OFF	23-7 to 23-11, 123	N/A	1,886,225	Apr. 8, 1997	Oct. 15, 1997	
24IN	24	22,050	877	Apr. 8, 1997		
124OFF	124	N/A	962,399	Apr. 8, 1997	Oct. 15, 1997	
25IN	25	22,050	2,989	Apr. 8, 1997		
125OFF	125	N/A	73,909	Apr. 8, 1997	Oct. 15, 1997	
26IN	26	22,050	0	Apr. 8, 1997		
126OFF	126	N/A	22,367	Apr. 8, 1997	Oct. 15, 1997	
27IN	27-3, 27-7 to 27-11	22,050	0	Apr. 8, 1997		
27OFF	27-1, 27-2, 27-4 to 27-6, 127	110,230	8,825	Apr. 8, 1997		
FR	28, 29	198,410	201,221	Apr. 8, 1997	Nov. 4, 1997	

*Openings and closures based on Notices to Industry
**Landings as of Jan 7, 1998
***Catch ceiling re-adjusted at time of re-opening of area 12 to allow for another 20,000 lbs shrimp in addition to previous landings

Table 4.2.8. Summary of Stock Assessment Surveys of Shrimp Stocks in B.C.

Area	Year	Month	Species	Biomass	Shrimp (thousands)				Shrimp/Kg
				(tonnes)	0 Year	1 Year	2 Year	3 Year	
12OUT	1997	NOV	Spiny Pink	7		8	889	716	230
			Smooth Pink	15					
			Humpback	0					
			Sidestripe	50	301	1,899	2,190	946	107
12IN	1997	APR	Spiny Pink	527		13,991	50,482	26,700	497
			Humpback	49		998	2,617	2,134	444
			Sidestripe	19		1,837	1,167	645	470
			Coonstripe	2					
		NOV	Spiny Pink	171	770	11,821	10,558	4,978	655
			Humpback	15	17	1,270	536	24	381
			Sidestripe	17	302	1,116	527	420	380
			Coonstripe	0					
			Smooth Pink	0					
123	1996	MAY	Smooth Pink	3,481		465,462	396,894	121,133	283
123	1997	MAY	Smooth Pink	1,136		67,832	200,088	56,242	285
124	1973	MAY	Smooth Pink	13,042		567,904	914,308	1,725,593	246
124	1975	MAY	Smooth Pink	14,155		220,484	1,132,662	2,072,664	242
124	1976	MAY	Smooth Pink	11,523		47,841	1,772,939	1,170,189	260
124	1977	MAY	Smooth Pink	5,742		24,338	755,827	846,257	283
124	1977	SEPT	Smooth Pink	5,413		62,630	751,724	496,517	242
124	1978	MAY	Smooth Pink	1,244		46,076	58,848	171,251	222
124	1978	SEPT	Smooth Pink	654		8,566	11,150	83,535	158
124	1979	MAY	Smooth Pink	1,234		49,096	102,591	113,418	215
124	1980	MAY	Smooth Pink	569		5,011	86,314	35,359	224
124	1981	MAY	Smooth Pink	1,602		39,967	207,687	113,992	226
124	1982	MAY	Smooth Pink	786		6,107	63,186	87,619	200
124	1983	MAY	Smooth Pink	23		219	1,477	2,610	185
124	1985	MAY	Smooth Pink	1,854		138,904	251,691	39,598	232
124	1987	AUG	Smooth Pink	4,389		227,119	503,485	191,882	210
124	1988	MAY	Smooth Pink	4,804		123,899	427,026	466,443	212
124	1989	MAY	Smooth Pink	3,636		48,064	542,137	296,091	244
124	1990	MAY	Smooth Pink	2,804		7,028	304,729	354,012	238
124	1991	MAY	Smooth Pink	2,930		64,361	260,822	354,565	232
124	1992	MAY	Smooth Pink	1,354		57,360	129,137	115,348	223
124	1993	MAY	Smooth Pink	1,018		18,609	153,012	58,016	226
124	1994	MAY	Smooth Pink	1,565		73,543	317,915	29,603	269
124	1995	MAY	Smooth Pink	601		10,528	113,882	26,657	251
124	1996	MAY	Smooth Pink	295		8,421	35,732	23,351	229
124	1997	MAY	Smooth Pink	590		22,549	111,537	27,334	274
125	1973	MAY	Smooth Pink	1,840		125,605	201,188	255,990	317
125	1975	MAY	Smooth Pink	2,324		31,897	208,198	313,027	238
125	1976	MAY	Smooth Pink	6,475		69,248	626,144	960,745	256
125	1977	MAY	Smooth Pink	4,001		80,028	863,875	291,430	309
125	1978	MAY	Smooth Pink	966		27,981	95,749	103,083	235
125	1978	SEPT	Smooth Pink	4,223		1,129	439,969	452,950	212
125	1979	MAY	Smooth Pink	1,341		94,597	159,197	125,515	283
125	1980	MAY	Smooth Pink	960		93,615	220,512	31,009	359
125	1981	MAY	Smooth Pink	2,287		115,614	320,724	198,532	278
125	1982	MAY	Smooth Pink	203		1,984	24,025	24,291	248
125	1983	MAY	Smooth Pink	836		14,994	195,329	24,081	280
125	1985	MAY	Smooth Pink	690		92,708	110,102	13,633	314
125	1987	AUG	Smooth Pink	1,575		78,314	190,641	81,916	223
125	1988	MAY	Smooth Pink	586		24,828	77,712	51,462	263
125	1990	MAY	Smooth Pink	965		32,067	179,897	83,846	307
125	1992	MAY	Smooth Pink	5,564		296,828	854,672	381,641	276
125	1993	MAY	Smooth Pink	3,483		62,671	708,586	226,234	286
125	1994	MAY	Smooth Pink	1,126		82,656	226,071	15,058	287
125	1995	MAY	Smooth Pink	985		36,828	214,699	28,795	285
125	1996	MAY	Smooth Pink	846		69,511	153,380	58,033	332
125	1997	MAY	Smooth Pink	417		13,994	66,359	30,832	267

Table 4.2.9. Summary of 1997 shrimp trawl landings (tonnes) by Shrimp Management Area and month, as reported on harvest logs (January to May), and on landing reports (June to December).

	Month													
	Jan to May - Harvest Logs[1]					Jun to Dec - Landing Records							Missing	
Shrimp Management Area	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Records	Grand Total
North Coast Areas:														
DXE					0.0							0.20		0.25
QCI					0.0									0.05
3IN			0.1	0.6	1.0	1.7	1.58	2.40	4.54	3.38	2.27			17.62
PRD	6.6		15.0	19.6	13.9	9.2	0.85	3.27	20.16	13.97	6.27	7.01	1.74	3.30	120.94
5IN			0.5		0.0			0.91					0.52	9.50	11.40
6IN					0.1	2.0				1.71	1.45	0.94	5.88	1.40	13.43
7IN					0.0						0.02		1.64		1.69
8IN								0.68					0.68		1.36
9IN			0.5	1.0	0.3	0.0		2.00	8.46						12.19
10IN											4.02	5.36			9.39
QCSND			0.3		0.0	28.4	115.14	216.54	100.12	70.09				10.50	541.02
Total Catch:	**6.6**		**16.4**	**21.2**	**15.4**	**41.3**	**117.6**	**225.8**	**133.3**	**89.1**	**14.0**	**13.3**	**10.7**	**24.7**	**729.35**
South Coast Inside Waters:														
11IN				0.0			2.04	1.36							3.40
12	1.8		8.7	2.0	0.4	8.7									21.73
12IN							11.68	27.79	3.44	78.78	3.46				125.16
12OUT							6.06	12.30	1.32				0.13		19.80
14	7.1		10.8	15.0	9.1	8.0	1.44	9.35	6.44	13.47	5.13	6.40	3.66	5.10	101.05
17					1.2	1.7	0.72	0.11	0.05	0.13	1.33	2.65	1.90	1.90	11.72
18	34.8		25.0	16.3	12.1	13.1	5.05	1.91	1.04	7.94	13.37	11.91	10.12	2.70	155.33
19	6.4		3.4	7.0	4.3	0.7	0.72	1.02	5.79	0.80	3.41	16.99			50.66
GSTE	9.2		8.1	21.7	8.0	12.3	1.25	13.32	10.13	10.89	17.89	18.90	10.15	1.80	143.62
FR					11.3	14.5	8.45	10.45	10.14	21.34	12.78	2.63		1.90	93.42
Total Catch:	**59.3**		**56.0**	**62.2**	**46.5**	**59.0**	**37.4**	**77.6**	**38.4**	**133.3**	**57.4**	**59.5**	**25.9**	**13.4**	**725.92**
West Coast V.I.														
21OFF					3.3	0.0									3.31
23IN	1.3		0.2	2.2	1.6	13.9	14.31	21.73	8.50	22.60	59.68	34.63	0.23	2.20	183.26
23OFF	0.5		0.0		12.7	68.9	69.89	223.77	121.70	273.64	90.23			4.50	865.89
24IN						0.0	0.15			0.16		0.17			0.51
124OFF					0.6	37.1	21.13	183.93	133.87	41.19	9.39				427.18
25IN											0.14	0.67			0.81
125OFF	11.6		5.2	11.2	8.4	2.2	1.95	0.32	1.16	14.51					56.57
126OFF								7.03							7.03
27IN	0.5		1.9												2.48
27OFF			0.6			6.1	0.45		1.47	2.08					10.71
Total Catch:	**14.0**		**7.9**	**13.5**	**26.6**	**128.2**	**107.9**	**436.8**	**266.7**	**354.2**	**159.6**	**35.5**	**0.2**	**6.7**	**1557.75**
Grand Total by area:	**79.8**		**80.3**	**96.9**	**88.5**	**228.5**	**262.9**	**740.2**	**438.3**	**576.7**	**231.0**	**108.3**	**36.8**	**44.8**	**3013.0**
Sale Slip Preliminary[3]	70.5		101.7	90.8	146	263.4									

Overall Catch Estimate[4]: **Jan - Mar (fish slips):** **257.0** **April - Dec (fish slips&Landing Reports):** **2848.5**

[1] Harvest log data is estimtated to be less than 80% complete compared to Landing Reports June to December, and 85% complete compared to fish slips January to May.

[2] Landing Records June to December plus missing records where hails where recorded but final landing records not received to date.

[3] Sale Slip data is preliminary and is not available by area - considered to be the most complete overall catch estimate for the time period

[4] The best overall preliminary catch estimate is calculated using the fish slip totals by month January to March (prior to the implementation of catch ceilings), fish slip totals for April and May (prior to the implementation of Landing Report System), and Landing Reports for the remainder of the yearJune to December 1997.

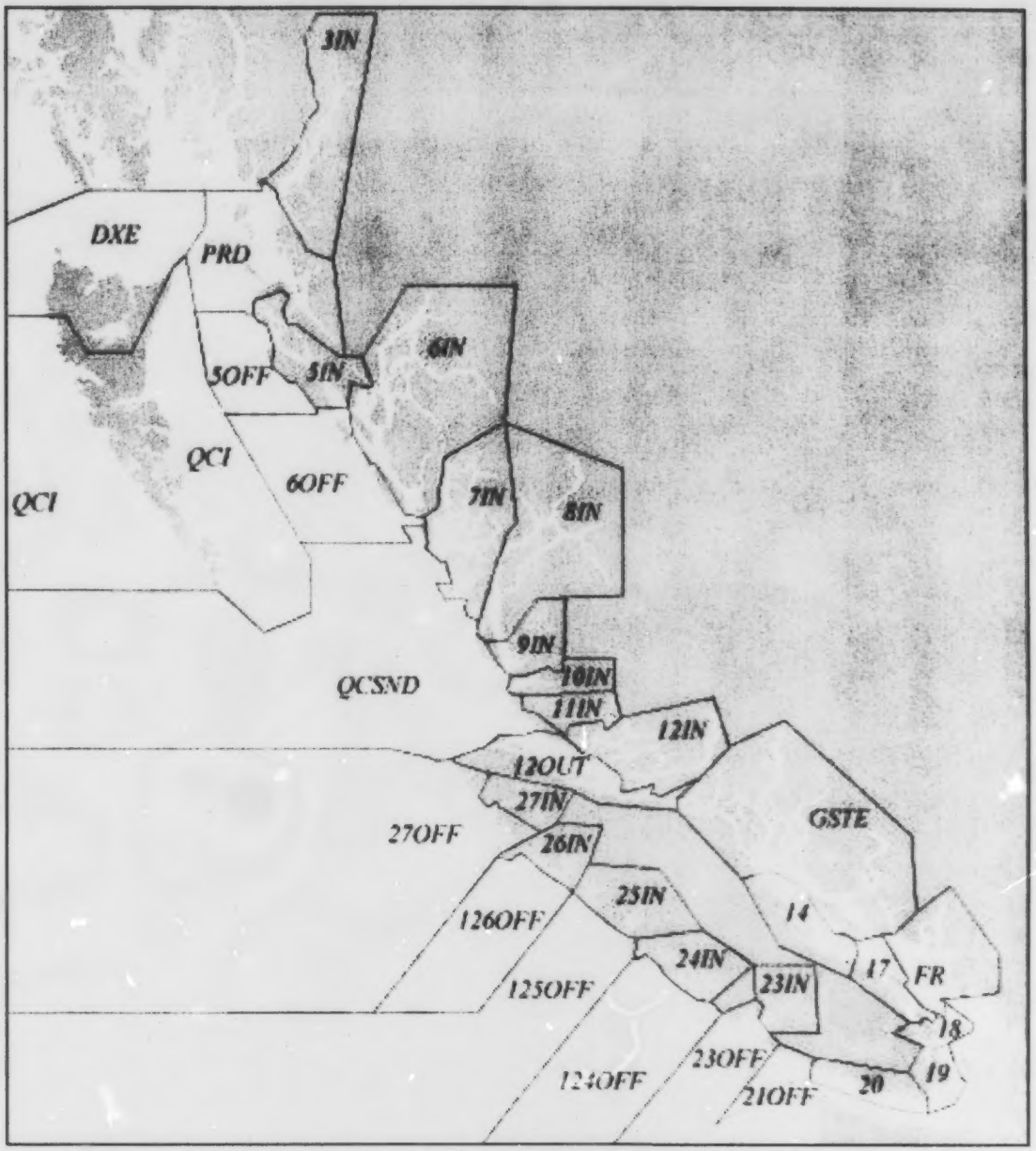

Figure 1. Shrimp Management Areas (SMA's) of the British Columbia Coast.

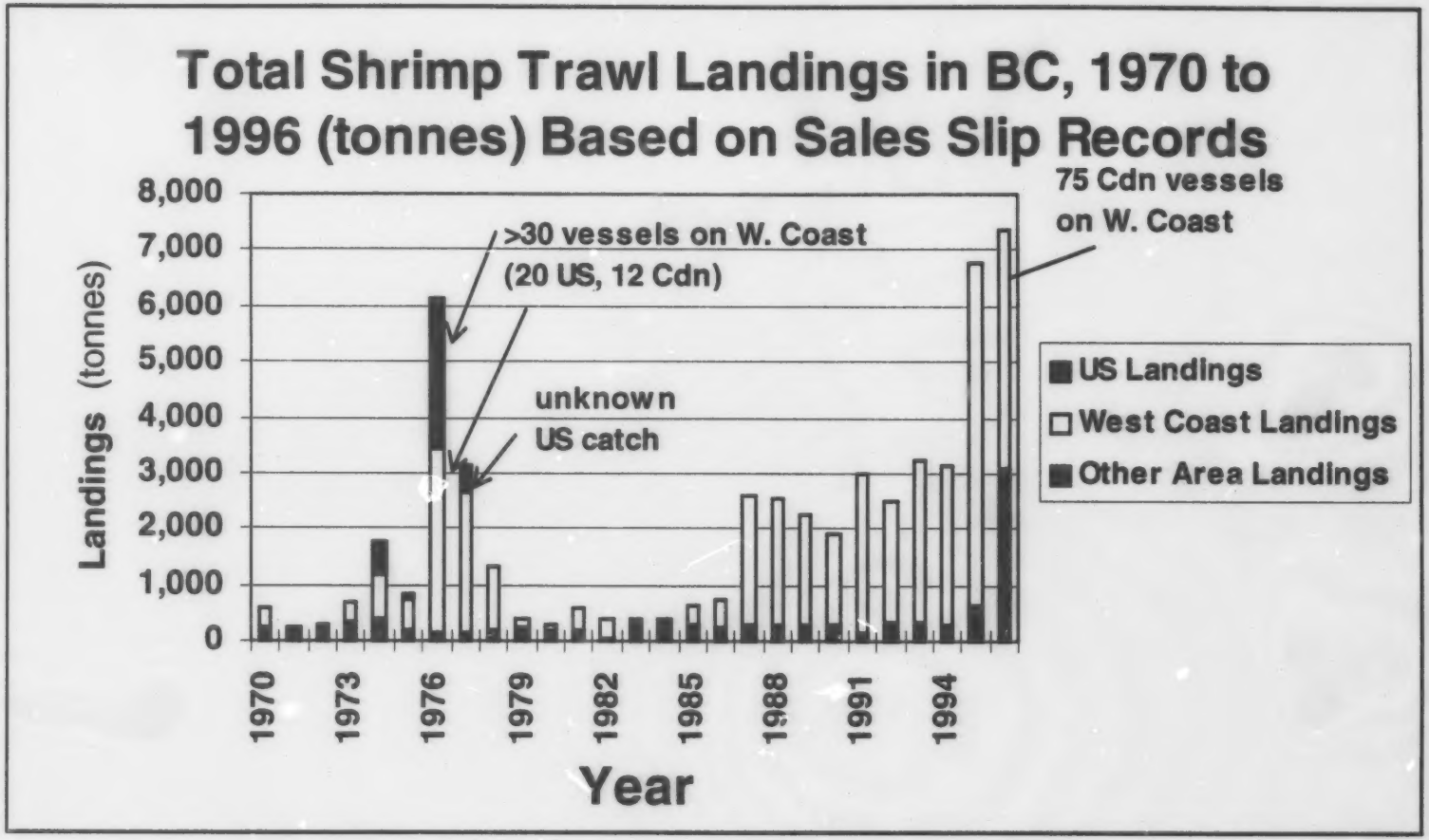

Figure. 2. West Coast Canadian, estimated west coast U.S. and other area landings, 1970 to 1996.

4.3. Prawn Trap Fishery (1996/97) - J. Morrison, M. Kattilakoski, I. Winther and J. Boutillier

This report discusses only the trap fishery for spot prawn. Other shrimp trap fisheries for coonstripe and humpback shrimp are not reviewed (see section 4.3.5.8). Landings are reported up to and including the 1997 fishing season. Data for the 1997 season is considered to be preliminary, subject to further verification and possible change. For the preparation of this report, all data from years prior to 1995 has been rechecked against the fish slip database records. This has resulted in changes within the data tables and differences from those data tables that have been published in earlier prawn fishery updates. The previous prawn fishery update was prepared in 1996. However, in the course of finalization of this report, 2 and possibly 3 significant sources of error have been identified. These are described in Section 4.3.1 regarding the landed value of the fishery, in Section 4.3.6.1. regarding landing records, and in Section 4.3.6.2. regarding effort.

In this report, the term "north coast" refers to marine areas managed by the North Coast Division, Statistical Areas 1 to 10 and adjacent offshore waters in Statistical Areas 101 to 110, 130 and 142, from Prince Rupert and the Queen Charlotte Islands south to Cape Caution which is on the mainland coast at a latitude approximately equal to the northern extremity of Vancouver Island. The term "south coast" refers to marine areas from Cape Caution south to the international border with the U.S., including the waters of Vancouver Island and adjacent offshore areas, in Statistical Areas 11 to 29 and 110 to 127. This includes marine areas managed by the South Coast Division and the Fraser River Division.

4.3.1 Introduction

The spot prawn Pandalus platyceros is the largest of six commercial pandalid shrimp species occurring in B.C. waters. It occurs at depths from the intertidal zone to 487 m (Butler, 1980). Prawns are caught by traps deployed on long-lines, set at variable depths along the shoreline, typically on rocky or coral bearing bottoms. There is a minor bycatch of prawns in the shrimp trawl fishery.

The prawn fishery occurs primarily in the South Coast and Fraser River Divisional areas (Areas 11 to 29) where 64% and 80% of the total catch was reported in 1996 and 1997 respectively. Prior to 1979 no significant landings were reported from the north coast. The fishery moved into northern areas following exploratory surveys during the mid 1970's (Boutillier and Cooke, 1976). All inshore areas (Areas 1 to 29) are now considered to be fully exploited. Opportunity remains to develop the fishery into offshore waters (Areas 101 to 130).

Licence limitation came into effect for this fishery in 1990. The category "W" licence replaced the category "Z-H" licence following a regulation consolidation in 1992. In 1994 there were 260 licences eligible for this fishery. By 1997 this was reduced to 257 through licence retirements. Not all licences are fished. In 1996 only 253 licences were renewed, and some of those licences were combined with other W licences on a single vessel, a process called licence stacking, to increase the vessel's trap limits. Approximately 10% of licences were stacked in 1995, 1996 and 1997.

Prawns are landed live, fresh or frozen in whole or tailed form. Frozen at sea (FAS) product is produced in all areas by vessels with freezer capability and is marketed primarily to Japan. The live and fresh products are generally landed from day vessels operating in south coast areas that are close to local markets. Some fresh product landings are converted in on-shore plants to frozen product for export. In 1996 and 1997, 90% - 95% of the landings were frozen product.

A price differential has existed between the products. Formerly live prawns had the highest value followed by FAS and fresh prawns. Ex-vessel price increased by up to 60% for FAS prawns in 1995, which exceeded live prawns in value. The whole landed value of prawns was $15.14/kg in 1996, a 64% increase since 1994. In 1997, a price differential between medium size grade FAS prawns and larger prawns was established by the markets. At the end of the fishing season the landed values for medium and larger prawns was $13.20/kg and $19.80/kg respectively.

The landed value of the prawn fishery exceeded $26 million (Cdn., Table 4.3.1) in 1996 and 1997. These were the highest landed values on record for this fishery. Although the overall landings increased slightly in 1997 over that recorded in 1996, the landed value reported on fish slips declined slightly reflecting the market changes for price by grade. However, a post season review of the fish slip data revealed some reported landed price per pound that was exceptionally low compared to the known landed value average. Subsequent recalculation of value based on reported weight landed and known average landed value suggests that in 1997 the true landed value of the fishery was in the range of $28.5M to $32.5M. Overall, the reported landed value appears to be approximately 80% to 90% of the true landed value.

Landed value for live and fresh product is adversely affected by market glutting following the season opening in April, and the shorter seasons since 1994. FAS prawn value is not affected in the same manner as it is a long term storable product.

4.3.2 Stock Assessment Objectives

Major biological objectives for the prawn fishery were to:

- Provide an inseason monitoring system for the south coast prawn fishery, and if possible expand it to the whole coast if additional industry funds were available.
- Provide fishery independent surveys of critical prawn management areas to address specific management problems and objectives.
- Compile, correct and collate fishery logbook and fishery independent data into a relational database.

The Science Branch Stock Assessment Program activities are described in section 6 of this report.

4.3.3 Fishery Management Objectives

Major fishery management objectives for the 1996 prawn trap fishery were to:

- Continue year 2 of the pilot prawn trap limitation program to cap gear inventory and manage escalating effort in this fishery.
- Co-ordinate deployment of charter patrol vessels with the Stock Assessment Division, to provide for increased biological monitoring throughout the coast.
- Implement closure recommendations from Stock Assessment Division in a timelier manner to prevent or reduce over-exploitation of local stocks.

Major fishery management objectives for the 1997 prawn trap fishery were to:

- Continue a one year extension of the pilot trap limitation program.
- In conjunction with the Stock Assessment Division, initiate biological monitoring as early as possible in the season to assess stock strength prior to significant fishing pressure.

- Open special management areas at a time and in a manner which would reduce fishing pressure and favour local fisher participation.
- Reduce potential fishing mortality by requiring sorting for undersized and berried females as each trap comes on board.
- Revise the logbook format to better meet both DFO and fishers' objectives.
- Refer to catch by grade and catch weight by trap information provided from fishers to supplement biological sampling results when considering closures and biological assessment area priorities.

4.3.4 Industry Objectives

These statements were tabled and discussed by industry licence holder representatives of the Prawn Sectoral Committee, in a caucus meeting in the spring of 1997. They were distributed to all licence holders for review, with the election ballot mail out in October 1997. The results have not yet been compiled for further review by the Prawn Sectoral Committee.

Conservation - to ensure conservation and protection of shellfish stocks coastwide through the application of scientific management principles.

- to prevent the decrease of overall biomass (need more stock assessment)
- to prevent the capture of sublegal prawns
- prevent recruitment overfishing
- to control the escalation of effort and efficiency
- increase minimum monthly spawner index in areas where/if stocks are depleted (need more stock assessment)

Optimum use of shellfish stocks - to ensure the optimal use of shellfish stocks in order to meet social and economic objectives of the people of Canada.

- to maximize the productivity and value of the existing biomass (productivity gains)
- prevent growth overfishing (a productivity gain, i.e. increasing the age of first capture to increase prawn size, weight and value)
- optimize the harvesting and marketing in frozen product
- optimize the harvesting and marketing in live and fresh product
- benefits of the fishery to go into the pockets of those who fish in the fishery
- target large prawns to increase price and productivity
- to develop and harvest all available stocks including the offshore stocks
- to control the escalating efficiency of the prawn fleet (obtain a more manageable rate of harvesting, less chance of over harvesting, ease of management)
- extend the season where possible to service live/fresh markets
- provide Canadians access to the resource by providing product to the fresh/live local markets

Consulting with users (to incorporate their goals and aspirations in management plans) - To develop fishing plans consistent with principles of conservation through a consultative process with users of the resource.

- to bring stability in the management of the fishery and the economics of prawn fishing operations

- recognize the rights of current stakeholders
- extend the season where possible
- to adopt management plans that are as inexpensive and effective as possible
- to recognize that the traditional character of the prawn fishery is allocation through competition

Optimum Product Quality - To optimize the quality of shellfish harvested

- target large prawns to increase price and productivity
- provide Canadians access to the resource by providing product to the fresh/live local markets
- extend the season where possible to service the live/fresh markets

Other Objectives

- to discourage licence concentration and monopolization of the fishery
- to develop the offshore fishery

4.3.5 Description of the Fishery

A summary of trap catch and effort for the period 1982 through 1997 is shown in Table 4.3.1. Table 4.3.2.1 and 4.3.2.2 provides trap landings by month and area for 1996 and 1997 respectively. Trap catch by management area for the period 1980 through 1997 is shown in Table 4.3.3. Tables 4.3.4. and 4.3.5. provide information on the minimum prawn bycatch in the shrimp trawl fishery.

A record of management strategies from 1979 to 1997 is provided in Table 4.3.6. Management of this fishery includes a minimum size limit, an annual seasonal closure to protect spawning stocks, licence limitation, hail requirements, trap mesh requirements to permit escapement, in-season closures based on a biological standard referred to as the minimum monthly spawner index (MMI) described more fully in section 4.3.6.1, and trap limitation. Closure information is shown in Tables 4.3.7. and 4.3.8.1 through 4.3.8.4.

4.3.5.1 Reported Landings and Data Entry Issues

Coast wide prawn trap landings increased from 264 t in 1982 to 1,754 t in 1997, the highest catch on record. These record landings were achieved concurrently with a reduction in the length of the season from 230 days in 1994 to 106 days in 1997, reflecting more conservative management protocols.

Since 1982, prawn landings from southern coastal areas increased annually to a maximum of 899 t in 1993, decreasing to 879 t in 1994 and increasing to 1408 t in 1997 (Table 4.3.3.). Area 12 (Queen Charlotte Strait to Knight Inlet) is the area with the greatest landings. The decline in Area 12 landings in 1993 and again in 1994 led managers to request a PSARC (Pacific Stock Assessment Review Committee) paper reviewing the status of stocks in this area in 1995. This paper was first tabled in the spring of 1996 and is discussed in Section 4.3.6. The analysis suggests that the 1993 and 1994 decline was within normal variability. The 1995 Area 12 landings recovered to what was then considered to be a normal level, and record landings were recorded for this area in 1996 and again in 1997.

Tables 4.3.2.1. and 4.3.2.2. report prawn trap landings in tonnes, by month and area for 1996 and 1997 respectively. This information is compiled from the fish slip database. In reviewing the data it was noted that entries for some fishers were the same for all areas that had been

fished and reported on that single fish slip. Initially this was assumed to be misreporting by the fishers. It was subsequently determined that the error is generated by Fisheries and Oceans when data is keypunched for the data base. The fish slips do not provide for catch differentiation by individual areas. Accordingly, when a single fishing trip reports catch from more than one Pacific Fishery Management Area, data coders allocate the catch equally among all areas reported on the fish slip.

This is the case in approximately 20% of the fish slip data base records for this fishery.

This error will be most prevalent in recent records. When the W licence fleet was largely a live and fresh fleet in the 1980's, trips were short and only 1 or a few management areas would be fished and reported on a single fish slip. Since then, freezers have been added to most of the fleet, trip length has increased between landings and consequently the number of management areas harvested between fish slip reports has also increased.

4.3.5.2 Reported Effort and Trap Haul Data Issues

Effort has been limited in this fishery by limiting the number of licences that can be issued, by specifying a maximum vessel length for each licence, and by limiting the number of traps that can be fished by a vessel.

Licence limitation in this fishery was introduced in 1990 at which time the length of the vessel was specified on the licence. The number of licences issued increased from 249 in 1990 to 263 in 1992 following an appeal process. There has been a retirement of "grandfathered" licences which were permitted to be fished only by the original owner, to 257 eligible licences in 1997.

Effort measured from logbooks as the number of trap hauls per vessel increased annually between 1982 and 1989 from approximately 5,000 to 12,000 trap hauls/vessel. Since licence limitation came into effect in this fishery in 1990, effort per vessel continued to escalate. Effort was reported as 15,000 trap hauls/vessel in 1990 and 21,700 trap hauls/vessel in 1994. This increase was due in part to discussions of additional control measures, which led to considerable speculation and increased effort in the fishery. Effort measured as the total fleet trap hauls per annum increased annually in the prawn fishery from 1.6 M trap hauls for the 1983 season to 4.8 M trap hauls in 1994 and then appeared to decline in 1995 following trap limitation (Table 4.3.1.). The reported total number of trap hauls in 1995 declined to 4.4 M, or 20,000 trap hauls/vessel.

Industry representatives questioned the accuracy of the trap haul data in the fall of 1997. Industry representatives allege that the true number of trap hauls far exceeds the trap hauls reported from the logbook database. For example, in 1995 there were more than 70,000 traps authorized for daily use in the fishery. The total trap hauls reported in logbooks of 4,444,000 divided among 70,000 traps would provide for 63 days of fishing by the full fleet, compared to the 195 days of fishing which were available during the season. This discrepancy cannot be accounted for by reduced in-season effort as vessels switch to other fisheries, or due to soak periods of 2 days or longer at the end of the season. Further consideration is needed to determine the source of the discrepancy. In 1995 fishers were predominantly single hauling, that is, hauling their traps once every 24 hours at the beginning of the season. The discrepancy predates the recent industry practice of double hauling, which was first noteworthy at the beginning of the fishing season in 1996 and has become more prevalent in 1997. The extent of this practice has not been determined.

4.3.5.3 Annual seasonal closure

From 1985 to 1988 an annual seasonal closure of the prawn fishery occurred in all south coast areas for the period of approximately January 1 to March 31 inclusive (Table 4.3.6). The closure was initially implemented in response to low spawner indexes in several of the most productive areas, which resulted in redistribution of the fleet to less productive areas. Since 1989 a coast wide seasonal closure (January to March) has been in effect, as the south coast seasonal closure caused effort to shift to northern areas. Since 1994 the overall season has shortened annually, from 230 days to 106 days in 1997. The earlier closures are attributable to the biological monitoring, provided by industry funded contract patrol personnel, which allows improved tracking of the stock status in-season. Many coastal areas were likely overfished annually prior to trap implementation and the industry funded monitoring program.

4.3.5.3.1 Prawn Management Study Areas and Dioxin Closures

Five south coast inlet areas, Alberni Inlet, Howe Sound, Salmon and Sechelt Inlets, and Saanich Inlet have been managed as discrete areas since the late 1980's (Table 4.3.6.). Management plans included delayed openings and trap limits derived through consultation with fishers. Up to 1992 these areas were designated study areas and were used to develop and evaluate alternate management scenarios that would allow optimum utilization of the resource. In 1992, these areas were removed from the study area status but continued as special prawn management areas with reduced trap limits and in some cases, delayed openings.

Dioxin closures for the prawn fishery were established during the period from 1988 to 1989. Closures included the head of Muchalat Inlet, portions of Howe Sound, and Prince Rupert Harbour. These closures were rescinded in 1995.

In the north coast Areas 2E and 2W in the Queen Charlotte Islands have been managed separately since 1989 due to a suspected low carrying capacity and limited stocks. Prior to 1995 these areas were open for the month of April only. Recent management of the Queen Charlotte Islands is described in the subsequent sections of this report.

Other former north coast study areas (Work Channel and Gardner Canal) reverted to normal status in 1992.

4.3.5.4 Management changes in the fishery, 1995 – Trap Limitation Pilot

There were two significant changes in the 1995 prawn fishery. The first was the introduction of trap limitation in the prawn fishery and the other was increased effort in the prawn fishery due to the poor salmon return of 1995.

Recommendations from the Prawn Sectoral Committee (PSC) in 1993 were to consider trap limitation as a method to control escalating effort. Industry was advised that trap allocation could only be considered if industry was prepared to provide the additional costs of implementing and enforcing the program. Each licence holder was balloted in late 1994, and asked to select between equal and variable trap allocations. Ninety-three percent of licence holders responded with 74% of the respondents selecting an option for an equal trap allocation per vessel.

The Minister of Fisheries and Oceans directed that trap limitation be initiated as a 2 year pilot program commencing in the 1995 fishing season. The intent of the program was to cap the escalating trap gear inventory. Single licenced vessels could deploy a maximum of 300 traps during the regular fishery opening and 150 traps within special management areas. Double licenced vessels (stacked licences) could deploy a maximum of 450 traps in the regular opening and 225 traps in special management areas. An additional management fee of $1135 per licence was used to underwrite enforcement of the trap limits through the chartering of observer

boats whose masters were qualified Observers or Fishery Guardians. Patrol vessel personnel were trained to undertake biological monitoring of the prawn spawner index. This proved important, as the fishery was subject to uncharacteristic sustained fishing effort throughout 1995 and 1996.

In 1995 all dioxin contamination closures for prawn were rescinded. Prince Rupert Harbour returned to its status as a Native and recreational fishing area. Because Muchalat Inlet and Howe Sound had been closed for several years allowing stocks to build, there was a concern that these areas would be intensively exploited by commercial fishers. Accordingly Muchalat Inlet was designated as a special management area with reduced trap limits and delayed openings, and the recovered Howe Sound areas were added to the existing Howe Sound special management area.

Muchalat Inlet on the West Coast of Vancouver Island near Gold River opened at the same time as the Alberni special management area on June 30, 1995. The Howe Sound special management area, as well as Indian Arm, Salmon and Sechelt Inlets and Saanich Inlet opened on September 18. Gear restrictions for the special management areas permitted single licenced vessels to use 150 traps in these areas and stacked (double) licenced vessels to fish 225 traps.

In 1995 the Queen Charlotte Islands opened with the remainder of the coast on April 19 and closed May 31. As these are remote fishing areas, which are sporadically fished by a limited number of vessels, it was not cost effective to provide in-season patrols or biological monitoring in these areas. Special weekly hail in requirements reporting catch by grade were required for anyone fishing these grounds.

In 1995 there were 100 fishing vessels which carried both a prawn (W) and a salmon (A) licence. Traditionally the mid-summer was a period of reduced prawn fishing effort as the combined A/W licenced boats switched to the salmon fishery. In 1995 some A/W fishers did not leave the prawn fishery, and others quickly returned from the disappointing salmon fishery. Overall, high levels of effort were sustained in the prawn fishery for the first time throughout the summer season.

4.3.5.5 Managment changes in the fishery, 1996.

In 1996, there were 257 vessels eligible to participate in the prawn fishery of which 253 licences were issued and 221 vessels reported landings. As part of the trap limitation program, some licences were stacked on a single vessel and therefore did not report landings for that year.

Industry requested and DFO agree to increase the minimum size limit from 31 mm to 32 mm carapace length, which is measured from the posterior margin of the eye socket to the posterior mid dorsal margin of the thoracic carapace. Fishing practices were also changing as more fishers began to "double haul" traps, particularly at the beginning of the fishery. Double hauling refers to the practice of raising the traps and recovering the catch twice in one day, instead of the historical practice of a 24 hour or longer soak. This may account in part for the increased average trap landings kg/day fished shown in Table 4.3.1.

In 1996, 36% of the coast wide prawn landings were reported from northern coastal areas. This was comparable to the preceding 2 years, which saw a significant increase from the 17% share of 1990. The 616 t landed from the north coast was the highest on record for that area.

In 1996 in response to industry requests, DFO tested an early season opening in Howe Sound. However, stocks appeared weak at that time. Howe Sound closed pending re-opening of all special management areas in the fall.

In 1996 the Queen Charlotte Islands opened with the remainder of the coast on April 15 and remained open until the general coastwide closure on Aug. 15. However, communication with this remote coastal area is difficult. Mandatory weekly catch by grade reporting from the fishing grounds was inadequate in 1996 and overfishing may have occurred.

In 1996 the salmon expectations continued to be poor, and almost all W licenced vessels remained in the prawn fishery until it closed coast wide on August 15, rather than switching to salmon fishing in mid season.

When the fishing plan had been developed in the spring, the 5 special management areas were scheduled to open in September. The opening date had been chosen to start the commercial fishery in these areas after the summer peak of the recreational fishery. As a consequence of the earlier than expected closure of the main fishing grounds, the fishery in the special management areas opened at a time when there were no other prawn fishing alternatives. Even though fishers could only use 50% of their trap limit in these areas, approximately 150 vessels participated in these late season fisheries. There was substantial competition among vessels for physical space on the fishing grounds. Almost continuous biological monitoring was required to ensure resource conservation. The special management areas remained open from 9 to 14 days. Although it was intense, the fishery was considered to be successfully managed. Nonetheless, the concentration of vessels generated critical public and media attention.

4.3.5.6 Managment changes in the fishery, 1997

The 2 year trap limitation pilot program was extended for one more year, for the 1997 season. This was once again a year of significant change. Industry and DFO agreed to increase the minimum size limit to 33 mm carapace length. With industry support, DFO implemented a requirement that all egg bearing prawns be released during the period from the fishery opening on April 15 to the end of June.

In 1997, all of the special management areas were opened on May 1. With the changed opening date for the head of Alb.erni Inlet, Muchalat Inlet was no longer required to open in tandem in order to spread fishing effort on the West Coast of Vancouver Island. Muchalat Inlet was removed from special management status and full trap limits were restored in this coastal area.

Following on the less than satisfactory experience with the Queen Charlotte fishery in 1996, DFO declared an intention to have this area open for 30 days only in 1997. Industry expressed an interest in funding in-season patrols and biological monitoring. A collaborative agreement for this program was drafted just prior to the season opening. However, it was too late for industry review and implementation. The fishery was opened in this area for 30 days only.

The four prawn management areas were opened 2 weeks after the main fishery opened. There was local recreational and First Nations opposition to the opening of the Saanich Inlet on May 1. As only 50% of the traps could be used in these areas and the fleet had already deployed throughout the coast to the main fishing grounds, the intensity of the fishery in the PMA's remained low and they were open for 2 to 3 months compared to the 10 to 14 days of the preceding season. This strategy was considered to be successful.

In 1997 the industry funded charter patrol vessels undertook biological sampling early in the season. The prawn stocks in north coast areas did not have a high spawner index at season opening and closures commenced after 31 days. All of the north and central coast was closed after 93 days. This shifted and concentrated effort to the south. Southern prawn stocks in inside waters were stronger than expected which sustained fishing until July 29, with a total season of 106 days.

The 1997 stock weakness in north coast requires further consideration to determine probable causes. North coast records have been inspected. There is no immediately obvious relationship between increased landings in 1995 and 1996, and reduced stock strength in 1997. Significant increased landings were recorded in preceding years in Areas 3, 5 and 6 but landings in other north coast areas were comparable or were reduced from previous years.

Salmon fleet changes, which began in 1996, altered fleet characteristics in 1997. Under a salmon licence buy back program, combined A/W salmon/prawn licenced vessels were allowed to retire their salmon licence. This permitted these vessels to become full time prawn trap fishery participants. This occurred with 18 vessels, 7% of the fleet.

4.3.5.7 Other recent changes in the fishery.

Prior to trap limitation, vessel masters would set as many traps as they could haul in a 24 hour or longer period, depending on vessel size to carry gear, and crew size. Some vessels set as few as 50 traps, and some would set in excess of 1000 traps. In response to trap limitation in 1995, by 1996 some vessels were double hauling, pulling all of their traps twice a day, particularly early in the season when stocks were robust. By 1997 most of the fleet was double hauling early in the season, some were triple hauling, and some vessels continued the practice of double hauling until the end of the season. Reduced soak times are thought to increase the catch of smaller medium grade prawn, as there is less time for the large prawn to drive the smaller prawn out of the trap.

Other changes since trap limitation include the construction and use of faster vessels. Many fishers report non-stop fishing during the season compared to the more leisurely fishing practiced by some licence holders prior to trap limitation. In 1994 and 1995 a single gear haul every 24 hours was common, and longer soaks were common later in the season. By 1997 an estimated 61% of fishers were double hauling their gear (lifting it twice in one day) and 6% tried triple hauling their gear, particularly at the beginning of the season (J. Morrison and M. Kattilakoski, 1997). Smaller prawn vessels are using more gear, trying to deploy their full trap allocation. Some short length vessels have made their licences eligible for stacking on larger vessels. In 1997 there were increasing reports of "mother ships" which would transfer traps to vessels on the grounds, or offload prawns for conveyance to buying stations, permitting the licenced vessel to remain fishing on the grounds. Licence values have gone up and there have been a high number of licence transfers. Between licence sales and vessel replacement, more than 30 % of the fleet has changed in the past 3 years. Licence leasing may be becoming more prevalent which is typical of higher value fisheries.

4.3.5.7.1 Notification and In-Season Management

In order to monitor in-season effort, fishers have been required to hail since 1991, notifying DFO of their prawn fishing activity. Hail reports are used to monitor fleet activity and to identify areas in need of in-season assessment or closure.

In 1996 and 1997, it was the usual practice of fishery managers, fishery management co-ordinators and stock assessment personnel to convene a weekly conference call once the fishing season was established. An up to date hail data base report was prepared and reviewed to assess changing fleet distribution patterns. Biological sample results received in the past week were presented. Stock assessment personnel recommended closures. Comments and advice received from fishers and charter patrol Guardians was discussed. The extent of the closures could be increased on the basis of their input. In 1996, and to a greater extent in 1997, catch by grade information provided by fishers was used to identify priority areas for assessment or to supplement in-season biological assessments when determining the need for closures. Closure boundaries and dates were decided. Priorities for charter vessel Guardian patrols and biological

sampling were set based on the hail report, sampling history and reports from the grounds. Following the conference call, closure notices were written and issued, advisory tape machine messages were changed, and a notice prepared for the weekly scheduled broadcast on the Canadian Coast Guard WX channel. VHF radio announcements were also made by charter patrol vessels or DFO patrol vessels in radio range of the affected areas.

Conference calls usually occurred on Friday mornings. Prawn (special) management areas were closed with only 48 hour notice, as they are located in areas with good radio communication. Generally, a 7 to 10 day closure notice was provided for other coastal areas, ensuring at least one CCG radio broadcast. When the closure involved a remote coastal area where notification is difficult, a 10 to 12 day notice was provided.

4.3.5.8 Humpback and Coonstripe Fisheries

All shrimp species are authorized for harvest under the "W" licence but with one exception, shrimp other than prawns are not harvested to any significant extent during the regular season due to the higher value of the prawn.

A directed humpback shrimp fishery occurs in Prince Rupert Harbour, from the trap fishery opening date to the end of the calendar year, annually. Prawn fishing by trap is also prohibited in Masset Inlet in the Queen Charlotte Islands in favour of humpback by trap fishing, although the effort in this area is very limited. A directed coonstripe shrimp by trap fishery occurs in Sooke Harbour and Basin in Area 20-6, annually from the beginning of November to the end of December. This area is fished primarily by local fishers. A voluntary 50 trap limit was established for this fishery in 1997 following representation from local fishers including First Nations.

Other than Prince Rupert Harbour, Masset Inlet and Sooke Harbour, trap fishing for other species of shrimp and octopus was not permitted following the closure of the trap fishery for prawns. This was to avoid incidental catch of prawns. As a result of the shorter trap fishing season, in recent years there has been increased interest by shrimp trap fishers to fish humpback and coonstripe shrimp after the prawn fishery has closed.

Coastwide reported landings from the shrimp by trap fishery were 84 tonnes combined humpback and coonstripe shrimp in 1995 and 63 tonnes in 1996. These reports are combined because of possible misreporting of the species on the fishers' logs. In the north coast, most shrimp landed are humpback shrimp. South coast landings include both humpback and coonstripe shrimp. Prince Rupert Harbour in Area 4 is the most significant humpback fishery on the coast. The average landings, in Prince Rupert Harbour from 1987 to 1994, were 8 tonnes. In 1995, reported landings increased to 51 tonnes (60% of coastwide humpback and coonstripe by trap landings). In 1996, landings from Prince Rupert Harbour declined to 23 tonnes (37% of coastwide humpback and coonstripe by trap landings). (Table 4.3.12.)

By comparison, the reported catch of coonstripe and humpback shrimp by the trawl fishery was 13 tonnes in 1995 and 120 tonnes in 1996.

4.3.6 Stock Assessment Activities

Stock assessment and research activities are carried out under the Prawn and Shrimp Project within the Department of Fisheries and Oceans, Science Branch, Stock Assessment Division, Shellfish Section. For 1996 the project focus continued to be on providing the in-season spawner index assessment of the prawn fishery. Additional research initiatives were carried out on identified high priority concerns as time permitted.

A PSARC paper was prepared on the "Assessment of Area 12 Prawn Fishery in Relation to Declines in Annual Catch". The major recommendations from the paper were: 1) to find a mechanism to ensure consistent biological samples be collected from the various areas, 2) develop a process to have industries input into tracking changing fishing patterns and fishing methods which impact on standardizing effective fishing effort, 3) delay the opening of the fishery until hatching is complete, 4) develop a framework to be proactive in response to reaching a biological reference point, and 5) to manage separately the southern and northern portions of Johnston Straits. As a result of this paper a voluntary sampling program was initiated using small mesh traps in the 1996 fishery.

4.3.6.1 Spawner Escapement Monitoring Program

A rapid expansion of the prawn fishery took place in 1979, which resulted in the development of an in-season management system that allowed for a minimum escapement of the spawning cohort within a management area. An index of spawner abundance is obtained by monitoring the age and sex composition of the commercial catch. This index of spawner abundance is then compared to a minimum monthly index (MMI) escapement criterion (Boutillier, 1987). Closures are implemented in statistical management areas or subareas following in-season assessments of the commercial catch, if the estimated index of spawner abundance from in season sampling is less than the MMI. Closures are in place until April of the following year to protect the remainder of the spawning (3^+) cohort in the management area through to the end of the larval hatching period.

In-season sampling and monitoring of the commercial prawn fishery increased considerably in 1995 due to the recovery of the trap limitation program management fee for use within the Pacific Region. Spawner index sampling was carried out by the Stock Assessment Division of the Pacific Biological Station as well as nine Prawn Charter Observers contracted with this new program. The onboard sampling encompassed examination of sex class and cohort composition of the commercial catches on a per trap basis as well as calculation of catch rates. The number of spawners (3+ yrs) per trap was standardized to compensate for soak time and trap types. The standardized index is compared to a minimum escapement index calibrated by month to account for natural mortality in the prawn stocks (Boutillier, 1987). Table 4.3.9. gives the target index for each month as well as the sex classes included in the calculation.

Table 4.3.10.0 shows the numbers of prawns by sex class in sampling at the beginning of the fishing season in 1996 and 1997 which provides an indication of the proportion of prawns which are still egg bearing at the time of the commercial fishery opening. Tables 4.3.10.1and 4.3.10.2 summarize in-season spawner index monitoring results by Pacific Fishery Management Area by month, in 1996 and 1997 respectively. Table 4.3.11. compares the biological sampling effort in 1997 to previous years.

Prior to the trap limitation program, in 1995, approximately 50 vessels were sampled each season in various areas, by DFO staff, contract and student personnel. Sampling was largely limited to management Areas 12 to 23. The number of traps sampled annually varied from 2300 to 6200.

A total of 638 strings (13,435 traps) were tested in 22 Management Areas for spawner index during the 1995 prawn fishery. The North Coast Division (areas 1-10) had 87 strings (1,848 traps) tested, South Coast Division (areas 11-27) had 525 strings (10,965 traps) tested, with the remaining 26 strings (622 traps) being sampled from the Fraser River Division management area (areas 28 & 29). The total number of traps sampled during 1995 doubled over any previous year and was three times higher than most years since 1980.

4.3.6.2 Research Survey Cruises

In addition to sampling of in-season commercial catches, stock assessment personnel from the Pacific Biological Station carried out four prawn research surveys in 1995. Two surveys were conducted in the Howe Sound special management area to monitor the population, which is being closed at a higher index then the present index. One survey was conducted in Knight Inlet to evaluate the effects of fish farms on prawn production and one soak time and trap efficiency experiment was conducted in Saanich Inlet.

4.3.6.3 Logbook and Biological Sampling Data Processing

A total of 55,592 prawn harvest log records were processed for 1995. In 1995, all historic prawn logbook records were changed from an electronic flat (ASCII) file format to a relational database format. A new hard copy format for prawn harvest logs was also introduced in 1995, which included a section for collecting more detailed gear information. In 1996, 59,722 prawn harvest log records were processed. In 1996 a new database system was developed to consolidate all prawn catch per unit effort (CPUE) and length frequency (LF) data in one location rather than in dozens of separate flat files. Utilities were created to enter data into the database, to load historical data from various sources, to generate reports and to output flat files for use by other data analysis programs. In the fall of 1996, an industry/DFO logbook committee made recommendations for logbook changes, which were adopted for the 1997 fishing season.

4.3.6.4 Saanich Inlet Sampling Program

In response to concerns expressed to DFO by some local recreational fishers, sampling of Saanich Inlet prawn stocks was undertaken in December 1997. The sampling used Ladner traps, which are a standard trap type in the industry, small mesh traps provided by the Stock Assessment Division, and double ring traps which are a new commercial trap type entering into the industry.

Preliminary results showed that the prawn stocks in the Inlet remained healthy, and were about 25% higher than the target spawner index for that time of year. Prawn populations were not evenly distributed. The catch in one area in the inlet was dominated by egg bearing females, and males and transitional sex prawns were prevalent in another. A third area characterized by shallower depths and less optimum habitat had low catches.

4.3.7 Enforcement Concerns

The enforcement focus in 1995 was to ensure that gear limits in the pilot prawn trap limitation program were met. This was the primary purpose of the additional $1135 management fee which fishers paid during licencing. Trap tags were issued and attached to all legal gear being fished and served as a visual cue for enforcement personnel. Compliance with trap limits was very high. Only one charge was laid for fishing with unmarked gear. Other charges and warnings were issued for failure to produce a licence, fishing during a closed time, improperly completed logbook, lack of a provincial fish buying station licence, no licence tabs and improperly marked gear. There were another 15 violations, but their specific nature cannot be determined from the records at hand.

There were widespread concerns expressed by fishers and the Prawn Sectoral Committee members regarding commercial sale of undersized prawns. The PSC requested that this topic receive additional enforcement attention.

In 1996 and 1997, Guardians continued to monitor on-board compliance in the prawn fishing fleet. In 1997, 85% of licence holders reported that a Guardian, in the course of the season,

had contacted them. 67% of the fishers reported that the Guardians had undertaken compliance checks while on board. No instances of excess traps were found in either of 1996 or 1997. Due to high compliance rates with the trap limitation program, Guardians were tasked with increasing responsibilities for biological monitoring of the spawner index.

In 1996 and 1997, DFO Fishery Officers paid increasing attention to reports of shrimp trawlers retaining prawn bycatch, particularly when the prawn trap fishery was closed. Investigations in the spring of 1997 in Malaspina Strait led to charges and a successful conviction.

Allegations of illegal sales of prawns caught under the authority of recreational fishing licences increased through 1996 to 1997, as well as gear in excess of recreational trap limits. Most of these reports are from Saanich Inlet, Howe Sound, Salmon and Sechelt Inlets and Alberni Inlet. These prawns are commonly sold privately to public and restaurants. These are particularly difficult offences to investigate. In January 1998, this matter was brought to the attention of the Sports Fish Advisory Board and their advice was sought on management changes that could reduce the effectiveness of illegal prawn harvest for commercial sales.

4.3.8 Prawn Sectoral Committee and Industry

The Prawn Sectoral Committee fishers representatives were elected to a 2 year term, by licence holder balloting in November 1995. In 1995, 15 ballots were required to elect a seat to the committee, and 30 or more ballots provided a maximum of 2 seats for any single organization. There was a total return of 185 ballots, 71% of the eligible 259 licences. Six organizations were elected, holding 8 seats. Two former participating organizations failed to receive sufficient ballots for re-election. The Chair of the Sectoral Committee subsequently appointed another seat to provide representation of First Nations fishers who participate in the commercial fishery.

A questionnaire was sent to all licence holders with the sectoral committee ballots in November 1995. The results of more than 30 questions regarding the fishery are summarized in an internal report (J. Morrison, 1995).

Prawn Sectoral Committee elections were held in the fall of 1997. The election protocol was essentially unchanged, except that licence holders were allowed to nominate a second choice on the ballot, to be counted if their first choice was unelected. There was a total return of 185 ballots, 72% of the licence holders. The six previous representative organizations were re-elected, but because of the changed election protocol for a second nomination, a total of 10 seats were elected. In addition, the Chair of the committee requested a commercial fisher of First Nations heritage to participate, who was also prepared to act as a contact person for central coast fishers.

A questionnaire was sent to all licence holders with the ballots in the fall of 1997. The results of more than 50 questions are summarized in an internal report (J. Morrison and M. Kattilakoski, 1998).

In order to provide broader stakeholder representation in the process of developing the commercial fishing plan, commencing in 1998 the Chair of the Prawn Sectoral Committee has made seats available at the main table for a representative of FAS buyers, of live and fresh buyers, of the recreational fishing sector by invitation to the Sports Fish Advisory Board, and for a First Nations representative from the B.C. Aboriginal Fisheries Commission. In PSC meetings, generally the discussion and participation is confined to those persons who sit at the main table. Observers are welcome, but do not have the same opportunity to directly participate.

4.3.9 Record of Consultation and Prawn Related Meetings

Jan.24.96 Prawn Sectoral Committee meeting, Nanaimo

Feb.15.96	Charter Patrol Guardian meeting, Courtenay
Feb.16.96	Prawn Sectoral Committee meeting, Courtenay
Apr.04.96	Charter Patrol Guardian training, Nanaimo
May.13.96	Saanich Inlet First Nations, Brentwood Bay
Sep.13.96	Meeting with Chief Simon Smith, Brentwood Bay
Oct.8-16.96	Meetings with individual PSC organizations.
Oct.24.96	Prawn Sectoral Committee meeting, Nanaimo
Nov.26.96	Logbook subcommittee meeting, Nanaimo
Dec.19.96	Prawn Sectoral Committee meeting, Nanaimo
Jan.10.97	Prawn Caucus meeting, Courtenay
Jan.15.97	Conference call arranged by Dave Smith re Association
--	Prawn Caucus meeting, Courtenay, DFO not in attendance
Feb.04.97	Prawn RAPP stock assessment meeting, Nanaimo
Feb.25.97	Prawn Sectoral Committee meeting, Nanaimo
Mar.06.97	Saanich Inlet public meeting, IOS
Mar.10.97	Prawn Sectoral Committee conference call
Mar.13.97	CCG meeting re WX broadcasts, Vancouver
Mar.13.97	Meeting with live/fresh buyers re short season impacts
Mar.22.97	Prawn Sectoral Committee conference call.
Apr.04.97	Prawn Charter Patrol Guardians meeting, Nanaimo
Apr.11.97	Saanich Inlet meeting, Chief V. Jacks & 2 commercial fishers, IOS
May 29.97	Sooke coonstripe trap fishers meeting, Sooke.
Jun.10.97	Meeting to discuss offshore fishery, K. Matsuzaki, Nanaimo.
Jul.xx.97	Conference call with partial sectoral committee to discuss offshore fishery.
Sep.23.97	Prawn Sectoral Committee meeting, Nanaimo.
Oct.xx.97	Conference call to discuss Treasury Board submission.
Nov.97	Re-election of Prawn Sectoral Committee representatives, licence holder survey.
Nov.97	Meeting with Ladner Trap, Pacific Net & Twine & Redden Net re: mesh size.

4.3.10 Priority Issues

- The north coast stocks were unexpectedly weak at the commencement of the fishing season in 1997. The reasons for this require consideration.
- 54% of fishers share the Prawn Sectoral Committee's concerns that stocks may be overfished in spite of significant improvements to in-season management and limiting catch based on spawner index assessments. 31% of fishers reported that stocks appeared to be in worse condition in 1997 compared to previous years, for those areas where they had prior fishing experience. The industry representatives have expressed a need for more stock assessment, concerns for the retention of undersized prawns, targeting on medium grade prawns (growth overfishing), escalating effort and efficiency, trap doubling (2 traps wired together and fished as one) particularly for bucket traps, over capitalization, and derby fisheries in special management areas. Some but not all industry representatives also expressed concerns for shorter fishing seasons, and new trap designs.
- Industry advisors report that prawn fishers selectively choose which trap lines will be hauled when approached by DFO personnel or Guardians who intend to undertake spawner index sampling. This could have a significant impact on the reliability of this management measure. The spawner index as an in-season management tool remains vulnerable to the variable effects of fishers' expertise and experience in a given area. For example, a fisher that has just arrived in an area and has not yet found the

appropriate fishing locations, or an inexperienced fisher will have low catch returns. If these fishers are sampled their results may be sufficient to create an unwarranted closure recommendation. Conversely, a more experienced fisher may bias spawner index results to favour a continued opening even when the majority of the stock in the surrounding areas has been fished down. Accordingly, as recommended by industry, additional information about % medium grade and lbs/trap catch rates was sought from the fishers in 1997 and referred to when planning sampling or closures.

- Industry representatives have requested DFO to analyze the available data to determine if the weight of prawns is declining for a given spawner index value. They allege that prawn size and weight appears to be diminishing on the grounds even though DFO is closing earlier and on higher indices than previously.
- Review of an earlier draft of this report by industry members of the Prawn Sectoral Committee has called into question the validity of estimates of total trap hauls prior to 1995, reported in Table 4.3.1. The source of the discrepancies should be determined.
- The practice of permitting fishers to report multiple trap hauls on a single logbook entry line which began in 1996 and was explicitly permitted in 1997 may now be affecting DFO's ability to estimate total trap hauls and to generate CPUE estimates.
- Fishers have adapted to trap limitation by double and triple hauling their gear, particularly at the season opening. The first reports of this occurring was in 1995 and it was more prevalent in 1996. In 1997, double hauling was practiced throughout the season. This practice may increase the catch of medium grade prawns resulting in growth overfishing, or may increase mortality rates when undersized and medium grade prawns are released.
- Following the 1996 fishery, sectoral committee representatives, DFO and some buyers including FAS buyers were generally concerned with the impact of the short fishing season on the live and fresh markets. The concern is with the strong and almost sole dependence on the Japanese market for FAS prawns. As well, the current conduct of the fishery results in unmanageable market gluts for the live and fresh markets early in the season.
- The 1996 special management areas fishery was short and intense due to the opening following the general coast wide closure, and the high number of boats which participated in these areas of limited extent. This concern was dealt with in 1997 by the early season opening of special management areas. However, First Nations and recreational fishers strongly objected to the early opening of Saanich Inlet.
- The fleet is split on the issue of managing to increase the length of the season. Some fishers have identified to DFO their interest in area licencing, staggered area openings, mid season closures, further trap reductions, and other measures to limit effort. Others are satisfied with the current management regime of a short intense highly competitive fishery.
- Some operators who consider themselves to be "local fishers" with a long history of fishing in a specific area object to incursions by other mobile elements of the fleet, particularly if they believe the area to be fished out. Other fishers are concerned that their fishing opportunity to harvest "homestead" stocks is impaired as these areas are shut down if fishing effort is concentrated into smaller areas late in the season.

- There have been 3 years of significant change in the fishery. Fishers and buyers are seeking a more stable management program. Development of a longer term multi-year management plan may be beneficial.
- The pilot trap limitation program should be formally evaluated and officially adopted as a continuing program within this fishery.
- There continued to be reports in the winter and spring of 1996/97 regarding shrimp trawl fishing on prawn grounds, in inlet portions of Area 12, in Subareas 13-15, 15-1 and in the Nanaimo area. Some investigations were undertaken and charges laid.
- There may be a benefit tc co-ordinating the openings of the shrimp by trap and shrimp by trawl fishery, to reduce the potential impact of trawling activities on prawn stocks at a time when there are numerous berried females still present on the grounds. A co-ordinated opening would also reduce the potential for bycatch and poaching.
- There was considerable discussion among Prawn Sectoral Committee members on the topic of bucket traps, double bucket traps and double ring modified traps in use in the fishery. The Committee is also concerned for small mesh, which may be in use in the fishery. The Committee is interested in further trap testing and reporting of results before determining if bucket traps should be phased out of the fishery.

4.3.10.1 Delaying the Season

There was considerable discussion about opening date, prawn stock conservation and the catch of spent females ("long skirts") at the February 1998 Prawn Sectoral Committee meeting. As a result, J. Morrison and M. Kattilakoski further reviewed the available data from the spawner index database and the tables of in-season monitoring results.

The data presented are from the spawner index database and Tables from this report.

Table 4.3.10.0, column 12 shows the percentages of spent females caught in April 1996 and April 1997. The catch of spent females is low in most areas. The one report of a higher number of spent females was from a single string of gear and may not be representative of the area.

Contrary to the data, some fishers believe that there are higher numbers of spent females available to the fishery at the start of the season. One possibility is misidentification of the pre-spawning females as spent females. Both have deep abdominal plates. Spent females will also have small hairs (plumose setae) on the swimming legs (pleopods).

The second point considered was the numbers of berried females at the beginning of the prawn fishing season in 1996 and 1997. This was highly variable from sample to sample (Table 4.3.10.0, column 9). In April 1997, north and central coast areas had higher numbers of berried females than the south coast when the fishery opened. However, some south coast areas (areas 12 and 13) showed a high incidence of berried females as well. Fishers also reported a high incidence of berried females in area 27 at the opening of the season in 1997.

The conservation risk of catching high numbers of berried females at the beginning of a fishing season depends on how many females had been left in that area when it closed in the previous season. If an area closed at or below index in the preceding season, all remaining females require protection in order to achieve conservation goals. For example, much of the north and central coast areas closed below the spawner index in 1996 (Table 4.3.10.1) and there remained high numbers of berried females in these areas at the beginning of the 1997 season (Table 4.3.10.0, column 10). In this scenario, even with 100% release of berried females, any additional fishing and handling mortality affects conservation. In south coast, portions of areas

12, 16, 25 and 26 were at or below the index when they closed in 1996 and some berried females had still not finished spawning by opening day in 1997. Accordingly, the catch of berried females in these areas were of concern with respect to the opening date in 1997.

Again in 1997, portions of the north and central coast were closed below the spawner index when they closed (Table 4.3.10.2). Based on the data gathered in 1997, spawning in these areas will not likely be completed by April 1998. Even if 100% of the berried females are released, handling mortality will affect conservation of the stocks. The concern in 1998 is not limited to north and central coast stocks. In 1997 important fishing grounds in Area 12 closed at index which means that all berried females should be protected at the start of the season in 1998. The concern for Area 12 is heightened because a high number of boats fish this area aggressively at the beginning of the season when berried females will still be present.

In conclusion, fishing where berried females remain from the previous season creates a conservation risk. The level of risk is increased if those areas closed on or below the spawner index in the previous season. Prawn managers remain convinced that a later opening date for the prawn fishery is needed for conservation purposes, and that the concern for loss of harvest opportunity on spent females is inconsequential in comparison.

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Table 4.3.1. Prawn trap fishery landings in tonnes and effort, 1982 to 1997.

Year	Number of Licences Issued	# of Trap Vessels with Landings	Trap Fishing Days[1] (10^3)	Ave. fishing days per vessel	Season length	Trap Landings (t)	Trap landings kg per day fished	Trap Landed Value ($x10^3$)	Trap Landed Value ($/kg)	No. of Traps Hauled[2] (10^3)	Mean CPUE (kg/trap)	Standardized[3] Mean CPUE (kg/trap)
1982	--	218[a]	7.2			264	36	1,633	5.96	--	--	--
1983	567[b]	276[a]	7.6			325	43	1,639	4.95	1,618	0.26	--
1984	633[b]	305[a]	9.1			378	41	3,262	4.58	2,136	0.24	0.39
1985	544[b]	241[a]	10.3			509	49	2,440	4.79	1,969	0.26	0.40
1986	531[b]	203	10.3	51		543	53	3,696	6.81	2,089	0.26	0.35
1987	698[b]	236	12.9	55		616	48	4,303	6.98	2,496	0.25	0.32
1988	677[b]	262	13.0	50		714	55	5,837	8.17	2,887	0.25	0.32
1989	901[b]	298	16.5	55		805	49	6,968	8.66	3,665	0.22	0.28
1990	249	202	14.7	73		757	52	6,979	9.22	3,284	0.23	0.31
1991	261	227	19.2	85		954	50	7,683	8.05	3,493	0.25	0.32
1992	263	223	19.9	89		1,166	59	9,397	8.06	4,098	0.31	0.41
1993	257	232	18.5	80		1,211	65	10,095	8.33	3,924	**	**
1994	257	228	21.1	92	230	1,307	62	12,126	9.28	4,851	**	**
1995[5]	253	222	22.4	101	195	1,299	58	17,718	13.64	4444[d]	**	**
1996	253	221	21.1	95	123	1,732	82	26,076	15.14	**	**	**
1997	250[4]	231	17.0	73	106	1,754	103	25541[c]	13.22 - 19.84	**	**	**

This table was amended in 1996 to reflect trap data only and to verify all figures. Accordingly, values will differ from those published in former fishery updates.

[a] may include trawl vessels, numbers not verified
[b] trap vessels, numbers not verified
[c] the true value in 1997 is estimated to be $28.5M to $32.5M, refer to section 4.3.1.
[d] the accuracy of these values are in question, refer to section 4.3.6.2.

[1] from fish slips
[2] from harvest logs
[3] standardized to trap type
[4] preliminary data
** data not available

Table 4.3.2.1. Summary of prawn trap landings in tonnes, by month and area in 1996 from fish slips.

	Total Coast (t)	North Coast (t)	South Coast (t)	ECVI (t)	WCVI (t)	NORTH COAST MANAGEMENT AREAS								
						1	2	3	4	5	6	7	8	9	10
Jan															
Feb															
Mar															
Apr	254	71	183	171	13		5	8	3	23	17	6	2	6	1
May	538	200	338	301	37		2	16	3	13	52	69	18	22	5
June	348	158	190	172	18			6	1	21	41	38	26	17	8
July	367	155	212	207	5		25	<		22	34	64	5	5	
Aug	149	32	117	115	2		16	<		2	10	5			
Sept	75		75	41	34										
Oct															
Nov															
Dec															
Totals	1,732	616	1,115	1,007	108		48	30	7	81	154	182	51	50	14

	SOUTH COAST MANAGEMENT AREAS																		
	ECVI, East Coast Vancouver Island & Fraser/Howe Sound											WCVI, West Coast Vancouver Island							
	11	12	13	14	15	16	17	18	19	28	29	20	21		23	24	25	26	27
Jan																			
Feb																			
Mar																			
Apr		81	18	7	28	23	4	<	1	5	4	2			5		6		
May	1	115	40	18	44	63	9	2		<	9		2		10	1	11	6	7
June	1	67	20	14	26	25	12	4	<		4				6	1	6	1	4
July	11	64	23	19	37	13	33	1	<	<	5				1	1	3		1
Aug	4	46	20	2	18	3	20	1		<	1				<		<		1
Sept						9			16	14	1				30		4		
Oct																			
Nov																			
Dec																			
Totals	16	372	122	60	153	137	77	8	17	20	25	2	2		52	3	30	7	13

< = catch reported is less than .5 t. (500 kg.)

This data may be inaccurate. Refer to report section 4.3.6.1.

Table 4.3.2.2. Summary of prawn trap landings in tonnes, by month and area in 1997 from fish slips.

	Total Coast (t)	North Coast (t)	South Coast (t)	ECVI (t)	WCVI (t)	NORTH COAST MANAGEMENT AREAS									
						1	2	3	4	5	6	7	8	9	10
Jan															
Feb															
Mar															
Apr	332	64	269	254	14		14	8	3	9	14	11	2	1	1
May	589	157	431	399	33		13	9	6	10	32	42	22	19	5
June	409	84	325	291	34		1	12	5	3	24	7	14	8	10
July	419	38	381	357	24			1	4		11	1	10	5	6
Aug	3	2	1	1		2			<						
Sept															
Oct															
Nov															
Dec															
Totals	1,752	345	1,406	1,302	105	2	29	30	18	22	81	61	48	33	22

	SOUTH COAST MANAGEMENT AREAS																		
	ECVI, East Coast Vancouver Island & Fraser/Howe Sound											WCVI, West Coast Vancouver Island							
	11	12	13	14	15	16	17	18	19	28	29	20	21	22	23	24	25	26	27
Jan																			
Feb																			
Mar																			
Apr	<	123	18	14	38	41	19	1		<	<				8		6		<
May	10	159	31	24	54	57	28	2	9	9	15				17		8	4	3
June	11	111	29	24	35	36	29	2	2	8	4		1	2	11	1	12	3	4
July	16	100	35	41	62	49	32	4	2	5	10		2		13	1	5	1	1
Aug	1	<																	
Sept			<																
Oct																			
Nov																			
Dec																			
Totals	38	493	112	103	189	184	108	10	13	23	29		3	2	49	2	31	9	8

< = catch reported is less than .5 t. (500 kg.)

This data may be inaccurate. Refer to report section 4.3.6.1.

Table 4.3.3. Summary of prawn trap landings in tonnes by year and area as reported on fish slips.

	TOTALS					NORTH COAST MANAGEMENT AREAS									
	Total Coast (t)	North Coast (t)	South Coast (t)	ECVI (t)	WCVI (t)	1	2	3	4	5	6	7	8	9	10
1980	361	102	259	221	39	<	1	4	6	2	29	19	24	13	4
1981	320	116	204	151	53		3	4	<	2	51	27	23	1	4
1982	264	70	194	113	81		2	2		1	30	15	12	4	3
1983	325	116	208	185	23	<	1	10	3	8	27	35	18	7	5
1984	377	89	288	249	39		<	2	3	7	37	17	14	2	6
1985	509	98	411	384	27	<	1	14	1	6	15	25	25	6	4
1986	543	126	415	390	25	<	4	25	4	5	25	22	21	13	7
1987	616	159	455	399	56	2	1	13	8	2	21	42	40	21	10
1988	714	233	481	411	70	1	4	12	21	1	40	82	38	18	17
1989	805	216	589	479	110	4	1	8	12	2	49	69	31	15	25
1990	757	126	631	555	75		5	2	8	1	20	39	19	17	16
1991	954	188	767	673	94	2		6	17	5	26	47	29	31	25
1992	1166	273	890	778	112	8	8	21	6	17	46	75	32	44	16
1993	1211	312	899	787	112	<	2	11	<	36	52	109	43	40	20
1994	1307	428	879	755	125			7	23	39	85	135	67	46	26
1995	1300	413	886	777	109			38	22	49	103	82	56	49	14
1996	1732	616	1115	1007	108		48	30	7	81	154	182	51	50	14
1997	1754	346	1408	1303	105	2	29	26	5	22	81	61	48	33	22

	SOUTH COAST MANAGEMENT AREAS																	
	East Coast Vancouver Island											West Coast Vancouver Island						
	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27
1980	2	49	24	12	8	47	32	13	7	25	2	<	<	16	1	14	<	7
1981	1	39	10	8	7	44	9	9	2	17	4			15	2	29	3	4
1982	3	33	8	3	3	22	11	5	<	20	5	1		13	1	59	<	7
1983	7	75	9	13	15	21	9	4	1	26	6	<		9		11	1	2
1984	9	63	23	12	20	52	21	14	1	22	12	1	1	21	5	8	2	1
1985	2	157	30	17	39	60	29	5	<	31	15	<		17		6	1	2
1986	1	158	31	8	54	63	27	2	12	24	9		<	20	1	3	<	2
1987	16	80	40	10	74	99	21	3	11	36	11	10		23	8	12	2	1
1988	8	130	33	21	89	63	16	5	8	23	15	9		19	1	22	17	2
1989	8	112	49	32	88	117	36	7	3	14	14	2		15	1	35	42	16
1990	4	231	54	26	93	78	33	6	5	12	14			13	4	20	21	17
1991	12	255	64	38	99	138	33	6	4	22	2			25	1	21	11	36
1992	7	277	71	59	150	126	44	7	15	14	9		<	28	<	22	31	32
1993	14	188	99	62	142	189	37	10	11	13	23	<		32	1	24	25	29
1994	18	159	98	49	165	156	49	22	9	8	21		<	42	4	45	19	15
1995	15	186	119	63	164	78	48	11	20	57	16	<		55	3	33	8	10
1996	16	372	122	60	153	137	77	8	17	20	25	2	2	52	3	30	7	13
1997	38	493	112	103	189	184	108	10	13	23	30		3	50	2	31	9	9

< = catch reported is less than 500 kg.

This data may be inaccurate. Refer to report section 4.3.6.1.

Table 4.3.4. Shrimp Trawl Prawn Bycatch Landings In Tonnes and Effort, 1982 to 1996.

Year	Trawl Vessels reporting Landings	Trawl Fishing Days[1] (10^3)	Trawl Landings[1] (t)	Trawl Landed Value[1] ($\$x10^3$)	Trawl Landed Value[1] ($/kg)
1982			9		
1983			6		
1984			3		
1985	35	583	5	24	4.79
1986	30	395	7	37	5.14
1987	53	749	4	23	5.88
1988	30	600	5	36	6.77
1989	66	1216	15	116	7.68
1990	34	580	4	27	6.51
1991	15	427	7	45	6.37
1992	10	134	2	12	5.56
1993	26	364	4	26	6.02
1994	12	119	2	7	4.67
1995[5]	15	95	<	5	4.50
1996	12	84	2	19	3.69
1997					

<= less than .5 t (500 kg)

[1] from fish slips

Table 4.3.5. Summary of prawn landings in tonnes, by trawl, by month in 1996, as reported on fish slips.

	Total Coast (t)	North Coast (t)	South Coast (t)	ECVI (t)	WCVI (t)	NORTH COAST MANAGEMENT AREAS									
						1	2	3	4	5	6	7	8	9	10
Jan	0.02		0.02	0.02											
Feb															
Mar	0.02		0.02	0.02											
Apr	0.07	0.02	0.04	0.00	0.04				0.02						
May	0.04		0.03	0.03	<										
June	0.03	0.02	0.01	0.01					0.02						
July	1.03	1.02	0.01	0.01					1.02					<	
Aug	1.11[1]	1.11[1]	<	<					1.11[1]					<	
Sept															
Oct															
Nov															
Dec															
Totals	2.31	2.17	0.14	0.09	0.04				2.17					<	

	SOUTH COAST MANAGEMENT AREAS																		
	ECVI, East Coast Vancouver Island & Fraser/Howe Sound											WCVI, West Coast Vancouver Island							
	11	12	13	14	15	16	17	18	19	28	29	20	21		23	24	25	26	27
Jan										0.01	0.01								
Feb																			
Mar											0.02								
Apr								<							0.04				
May				0.03				<							<				
June						<		0.01											
July								0.01											
Aug		<						<											
Sept																			
Oct																			
Nov																			
Dec																			
Totals				0.03				0.02		0.01	0.03				0.04				

< = catch reported is less than .005 t (5 kg).

[1] The accuracy of one high landing report is being determined.

Table 4.3.6. Record of Management Strategies

Year	Spawner Index Mgmt.	DFO & PSC	Licencing & Reporting	Size Limits & Traps	Study & Special Management Areas
1979	Management to minimum spawner escapement commences.	assessment by Resource Services Branch (Science)			
1980					
1983	index compared to 80% upper confidence interval of sample means; strings pooled, boats averaged equally	assessment transferred to Field Services Branch (Operations)	separate Z licence established; harvest log requirement established		
1984	males often but not always included in spawner index calculations; 80% C.I. used				
1985	males not often included in spawner index calculations			30 mm. carapace length minimum size limit in regulation but not implemented	6 study areas initiated; Work Channel, Gardner Canal, Rivers Inlet, Sechelt Inlet, Alb.erni Canal, Howe Sound
1986					
1987					
1988	75% C.I. used, no males			trap escapement modifications implemented; 30 mm. minimum size limit put into effect	Saanich Inlet managed as a special management area (delayed openings)
1989	trap types standardized for calculation of spawner				Area 2E and 2W managed as a

F3

	index; 75% C.I. used				discrete fishery
1990	traps as point samples rather than strings as point samples		licence limitation implemented, 1000 lb.s. landed in any two years of 1986 - 1988; 259 licences	standardized marking of gear required	
1991		Prawn Sectoral Committee established.		trap limitation discussions commence	
1992			W licence replaces Z-H licence; hail requirements established every 4 weeks		6 study areas removed from study area status but still managed as discrete fisheries
1993			daylight fishing only initiated		
1994		ballot for trap limitation and program funding	hail every 2 weeks	max. trap size 140 L.; trap limitation delayed for enforcement plan	
1995	75% C.I., no males	assessment transferred to Stock Assessment Division (Science); PSC election	hail every 4 weeks	trap limitation initiated for 2 year pilot program; 300 traps or 450 for 2 (max.) stacked licences; max trap volume 170 L	Muchalat Inlet added to special management areas; remainder of Howe Sd. added to existing SMA (dioxin closures rescinded)
1996	sample mean used as point of comparison to the MMI.	Association discussions commence	258 eligible licences 253 licences issued	32 mm. size limit adopted	Howe Sd. opened April 15 for 10 days All SMA's opened Sept. 9 for 7 to 14 days
1997	fishers' % medium catch levels considered in closure decisions	PSC election fall 1997	257 eligible licences logbook format changed	trap limitation pilot extended 1 year 33 mm. size limit adopted berried female release until June 30	Muchalat Inlet removed from SMA status QCI opens April 15 for 30 days All SMA's open May 1 for 1 to 2 months.

Table 4.3.7. General Openings & Closures

Year	General Openings & Closures, Special Management Areas and other Delayed Openings
1979	Fishing open throughout the year.
1985	**First South Coast annual closure**, from Jan.4.85 to Mar.31.85; North Coast open throughout the year South Coast re-opens Apr.01.85 Saanich Inlet Area 19 did not open this year Howe Sound Area 28 opening delayed to May 1
1986	South Coast re-opens Apr.01.86 Saanich Inlet opening delayed to XXX Howe Sound Areas 28 and 29 open May 1
1987	South Coast annual closure Jan.10.87 to Mar.31.87; South Coast re-opens Apr.01.87
1988	South Coast annual closure Jan.01.88 to Mar.31.88; South Coast re-opens Apr.01.88 Saanich Inlet opening delayed to Sept.
1989	**First North Coast annual closure**, Dec.31.88 to Mar.31.89, open Apr.01.89 to Dec.14.89 South Coast annual closure Jan.01 to Mar.31.89, open Apr.01.89 to Dec.31.89 Queen Charlottes — opens for Sept. only Saanich Inlet — opening delayed to Sept.
1990	Coast wide closure — Jan.01 to Mar.31.90; coast re-opens Apr.01 Queen Charlottes — opens for Sept. only Salmon/Sechelt — opening delayed to Sept.3 with 200 trap limit Dioxin and furan — closures in Howe Sound, Pr. Rupert and Muchalat Inlet in Nov.
1991	Coastwide closure — Jan.01 to Mar.31.91; coast re-opens Apr.01 Queen Charlottes — open Sept. only;
1992	Coastwide closure — Jan.01 to Mar.31.92; coast re-opens Apr.01 Queen Charlottes — opens April only Howe Sound — opens Jul.8 with 250 traps, 50 traps/line, 5 groundlines (250/50/5) Salmon Sechelt — opens with trap limits Saanich — opens with trap/groundline limits 200/50
1993	Coastwide closure — Jan.01 to Mar.31; coast re-opens Apr.01 Queen Charlottes — opens April only Alb.erni — opens with 240/40 trap limits Howe Sound — opens with 250/50 trap limits Saanich Inlet — opens Sept. 13 with 200/50 trap limits Salmon/Sechelt — opens with 250/50 trap limits
1994	Coastwide closure Jan.01 to Mar.31.; coast re-opens Apr.01 South Coast closed Nov.18; North Coast closed Nov. 24 Alb.erni — opens Jun.27 with 240/40/6 trap limits Howe Sound — opens Apr.1 with 250/50/5 trap limits Saanich Inlet — opens Sept.12 with 200/50/4 trap limits Salmon/Sechelt — opens Apr.1 with 250/50/5 trap limits

Table 4.3.7. cont'd. Openings & Closures

Year	General Openings & Closures, Special Management Areas and other Delayed Openings
1995	Coastwide closure Jan.01 to Apr.18; Coast re-opens Apr.19; season opening delayed due to trap limitation implementation delays; Coastwide closure Oct.30 Dioxin and furan closures rescinded; Muchalat Inlet becomes special management area Howe Sound dioxin area added to Howe Sd. special management area Alb.erni Inlet opens Jun.30, 150/3 or 225/4 trap/groundline limits; closed Aug.28 Muchalat In. opens Jun.30, 150/3 or 225/4 trap groundline limits; closed Sep.18 Howe Sd./Indian A. opens Sep.18, 150/3 or 225/4 trap groundline limits; closed Oct.3 Saanich Inlet opens Sep.18, 150/3 or 225/4 trap groundline limits; closed Oct.13 Salmon/Sechelt opens Sep.18, 150/3 or 225/4 trap groundline limits; closed Oct.18 Queen Charlottes
1996	Coastwide closure Jan.01 to Apr.14; Coast re-opens Apr.15; season opening delayed to protect ovigerous females; Coastwide closure Aug.15 Howe Sd./Indian A. opens Apr.15, 150/3 or 225/4; Howe Sd. closed Apr.25 Howe Sd./Indian A. reopens Sep.09 with 150/3 or 225/4 trap/groundline limits closed Sep.16 Alb.erni Inlet opens Sep.09, 150/3 or 225/4 trap/groundline limits closed Sep.23 Muchalat Inlet opens Sep.09, 150/3 or 225/4 trap/groundline limits closed Sep.23 Saanich Inlet opens Sep.09, 150/3 or 225/4 trap/groundline limits closed Sep.23 Salmon/Sechelt opens Sep.09, 150/3 or 225/4 trap/groundline limits closed Sep.20 Queen Charlottes
1997	Coastwide closure Jan.01 to Apr.14; Coast reopens Apr.15; non-retention of ovigerous females until June 30; Coastwide closure Jul.29 (north coast closure Jul.16) Howe Sd./Indian A. opens May 1, 150/3 or 225/5 trap/groundline limits closed Jun.5 & Jul.2 Alb.erni Inlet opens May 1, 150/3 or 225/5 trap/groundline limits closed Jul.17 Muchalat Inlet removed from special management area status Saanich Inlet opens May 1, 150/3 or 225/5 trap/groundline limits closed Jun.24 Salmon/Sechelt opens May 1, 150/3 or 225/5 trap/groundline limits closed Jul.29 Queen Charlottes opens Apr.15, full trap allocations, closed May 15

Table 4.3.8.1. 1994 openings and closures.

Area	Sub-Areas	Closure	Days Open
South Coast	121-127	opened 1-Apr; closed 18-Nov	232
North Coast	101-110,130,142	opened 1-Apr; closed 24-Nov	237
1	all	24-Nov	237
2	all	30-Apr	30
3	all	24-Nov	237
4	1 to 9, 12 to 15	24-Nov	237
5	all	24-Nov	237
6	all	24-Nov	237
7	all	24-Nov	237
8	all	24-Nov	237
9	all	24-Nov	237
10	all	24-Nov	237
11	all	18-Nov	232
12	1 to 21, 24, 25	18-Nov	232
12	22, 23, 26 to 37, 38, 40, 43 to 48	31-Jul	122
12	39, 41, 42	5-Oct	188
13	all	18-Nov	232
14	all	18-Nov	232
15	all	18-Nov	232
16	1 to 4, 10 to 22	18-Nov	232
16	5 to 8	Prawn Special Management Area opened 1-Apr; closed 13-Jul	104
16	9	13-Jul	104
17	all	21-Oct	204
18	all	18-Nov	232
19	1 to 6	18-Nov	232
19	7 to 12	Prawn Special Management Area opened 12-Sep; closed 5-Oct	24
20	all	18-Nov	232
21	all	18-Nov	232
22	all	18-Nov	232
23	1 to 3	Prawn Special Management Area opened 27-Jun; closed 21-Aug	56
23	4 to 11	18-Nov	232
24	all	18-Nov	232
25	1	dioxin clos.	0
25	remainder	18-Nov	232
26	all	18-Nov	232
27	all	14-Oct	197
28	1, 2	Prawn Special Management Area opened 1-Apr; closed 26-Apr	26
28	3, 4, 5	dioxin clos.	0
28	6, 7, 9, 11 to 14	18-Nov	232
29	all	18-Nov	232
101-110,130,142		24-Nov	237
121-127		18-Nov	232

Table 4.3.8.2. 1995 openings and closures.

Area	Sub-Areas	Comments	Days Open
Sout Coast		opened 19-Apr; closed 30-Oct	195
North Coast		opened 19-Apr; closed 30-Oct	195
1	all	30-Oct	195
2	all	31-May	43
3	all	30-Oct	195
4	1 to 9, 12 to 15	30-Oct	195
5	13 to 19	30-Aug	134
5	remainder	5-Sep	140
6	all	3-Oct	168
7	all	22-Jul	95
8	all	25-Aug	129
9	all	5-Sep	140
10	all	5-Sep	140
11	all	30-Oct	195
12	1 to 21, 24, 25	30-Oct	195
12	22,23,26 to 37	4-Jun	47
12	38 to 40, 42	16-Aug	120
12	41, 43 to 48	12-Jul	85
13	all	30-Oct	195
14	all	6-Oct	171
15	1	28-Aug	132
15	3, 4	16-Aug	120
15	remainder	18-Sep	153
16	1 to 4, 9 to 18	12-Jul	85
16	5 to 8	Prawn Special Management Area opened 18-Sep; closed 18-Oct	31
16	19 to 21	16-Aug	120
16	22	6-Oct	171
17	all	6-Oct	171
18	all	30-Oct	195
19	1 to 6	30-Oct	195
19	7 to 12	Prawn Special Management Area opened 18-Sep; closed 13-Oct	26
20	all	30-Oct	195
21	all	30-Oct	195
22	all	30-Oct	195
23	1 to 3	Prawn Special Management Area opened 30-Jun; closed 28-Aug	60
23	4 to 11	28-Aug	132
24	all	18-Sep	153
25	1	Prawn Special Management Area opened 30-Jun; closed 18-Sep	81
25	3 to 5	30-Jun	73
25	remainder	18-Sep	153
26	4, 6	24-Jul	97
26	remainder	18-Sep	153
27	all	18-Sep	153
28	1 to 5, 11 to 14	Prawn Special Management Area opened 18-Sep; closed 3-Oct	16
28	6, 7, 9	3-Oct	168
29	1 to 4, 6 to 10	30-Oct	195
29	5	6-Oct	171
101-110,130,142		30-Oct	195
121-127		18-Sep	152

Table 4.3.8.3. 1996 openings and closures.

Area	Sub-Areas	Comments	Days Open
South Coast		Opened 15-Apr; closed 15-Aug	123
North Coast		Opened 15-Apr; closed 15-Aug	123
1	1 to 5, 7	closed 15-Aug	123
2	1 to 19, 31 to 100	closed 15-Aug	123
3	all	closed 4-Jun	51
4	1 to 9, 12 to 15	closed 4-Jun	51
5	1 to 9, 23, 24	closed 10-Jul	87
5	remainder	closed 31-Jul	108
6	1 to 4	closed 19-Jun	66
6	12 to 19	closed 24-Jul	101
6	remainder	closed 8-Aug	116
7	all	closed 24-Jul	101
8	all	closed 28-Jun	75
9	all	closed 28-Jun	75
10	all	closed 28-Jun	75
11	all	closed 15-Aug	123
12	28 to 34, 40 to 48	closed 12-Jun	59
12	remainder	closed 15-Aug	123
13	all	closed 15-Aug	123
14	1 to 5	closed 31-Jul	108
14	7	closed 8-Aug	116
14	remainder	closed 15-Aug	123
15	all	closed 15-Aug	123
16	1 to 4, 16, 18	closed 5-Jul	82
16	9, 11 to 15	closed 17-Jul	94
16	10, 17, 19 to 21	closed 19-Jun	66
16	22	closed 15-Aug	123
16	5 to 8	Prawn Special Management Area opened 9-Sep; closed 20-Sep	12
17	all	closed 15-Aug	123
18	all	closed 15-Aug	123
19	1 to 6	closed 15-Aug	123
19	7 to 12	Prawn Special Management Area opened 9-Sep; closed 23-Sep	15
20	all	closed 15-Aug	123
21	all	closed 15-Aug	123
22	all	closed 15-Aug	123
23	4 to 11	closed 3-Jul	80
23	1 to 3	Prawn Special Management Area opened 9-Sep; closed 23-Sep	15
24	all	closed 8-Aug	116
25	2 to 5	closed 19-Jun	66
25	6 to 8, 15, 16	closed 8-Aug	116
25	9 to 14	closed 3-Jul	80
25	1	Prawn Special Management Area opened 9-Sep; closed 23-Sep	15
26	all	closed 4-Jun	51
27	all	closed 8-Aug	116
28	1	Prawn Special Management Area opened 15-Apr; closed 25-Apr	11
28	2 to 5	Prawn Special Management Area opened 15-Apr; closed 25-Apr; re-opened 9-Sep closed 16-Sep	19
28	6,7,9	closed 15-Aug	123
28	11 to 14	Prawn Special Management Area opened 9-Sep; closed 16-Sep	8
29	1 to 6, 7, 9, 10	closed 15-Aug	123
101, 102, 130, 142		closed 15-Aug	123
103, 104, 108 to 110		closed 28-Jun	75
105, 107		closed 31-Jul	108
106		closed 8-Jul	85

Table 4.3.8.4. 1997 openings and closures.

Area	Sub-Areas	Comments	Days Open
South Coast		opened 15-Apr closed 29-Jul	106
North Coast		opened 15-Apr closed 16-Jul	93
1	all	15-May - 1 month opening	31
2	all	15-May - 1 month opening	31
3	all	closed 12-Jun	59
4	1 to 9, 12 to 15	closed 16-Jul	93
5	all	closed 4-Jun	51
6	19	closed 4-Jun	51
6	remainder	closed 24-Jun	71
7	all	closed 23-May	39
8	5 to 12	closed 12-Jun	59
8	remainder	closed 2-Jul	79
9	2 to 11	closed 15-May	31
9	remainder	closed 2-Jul	79
10	all	closed 2-Jul	79
11	all	closed 29-Jul	106
12	20 to 48	closed 10-Jul	87
12	remainder	closed 29-Jul	106
13	21, 22, 42, 43	closed 17-Jul	94
13	remainder	closed 29-Jul	106
14	all	closed 29-Jul	106
15	6	closed 10-Jul	87
15	remainder	closed 29-Jul	106
16	5 to 8	Prawn Special Management Area opened 1-May; closed 29-Jul	90
16	remainder	closed 29-Jul	106
17	all	closed 29-Jul	106
18	all	closed 29-Jul	106
19	7 to 12	Prawn Special Management Area opened 1-May; closed 24-Jun	55
19	remainder	closed 29-Jul	106
20	all	closed 17-Jul	94
21	all	closed 17-Jul	94
22	all	closed 17-Jul	94
23	1 to 3	Prawn Special Management Area opened 1-May; closed 17-Jul	78
23	remainder	closed 17-Jul	94
24	all	closed 17-Jul	94
25	all	closed 10-Jul	87
26	all	closed 17-Jul	94
27	all	closed 17-Jul	94
28	1 to 4, 11 to 14	Prawn Special Management Area opened 1-May; closed 2-Jul	63
28	5	Prawn Special Management Area opened 1-May; closed 5-Jun	36
28	6, 7, 9	closed 23-Jul	100
29	1 to 4, 6, 7, 9, 10	closed 23-Jul	100
101, 102, 142		closed 15-May	31
103		closed 12-Jun	59
104, 130		closed 16-Jul	93
105		closed 4-Jun	51
106		closed 24-Jun	71
107		closed 23-May	39
108 to 110		closed 2-Jul	79
111, 121, 123, 124, 126, 127		closed 17-Jul	94
125		closed 10-Jul	87

Table 4.3.9. Target Spawner Index as well as the Sex Classes Used in the Calculation

MONTH	ESCAPEMENT INDEX	SEX CLASS INCLUDED IN INDEX CALCULATION
APRIL	6.4	some 1's, all 2's and 3's
MAY	5.9	some 1's, all 2's and 3's
JUNE	5.4	some 1's, all 2's and 3's
JULY	4.9	some 1's, all 2's and 3's
AUGUST	4.4	all 2's and 3's
SEPTEMBER	4.1	all 2's, 3's, and 4's
OCTOBER	3.6	all 3's and 4's
NOVEMBER	3.2	all 3's and 4's
DECEMBER	2.7	all 4's
JANUARY	2.4	all 4's and 5's
FEBRUARY	2.0	all 4's and 5's
MARCH	1.7	all 4's and 5's
	1's	mature males
	2's	transitions
	3's	females, no eggs
	4's	females with eggs (berried)
	5's	spent females

Table 4.3.10.0. Numbers of prawns by sex class for April sampling in 1996 and 1997.

1	2	3	4	5	6	7	8	9	10	11	12
year	month	Area	NumTraps	Immature	Male	Transition	Female	Berried	% berried	Spent	% Spent
1996	4	7	14	10	165	33	11	0	0.00%	3	1.35%
1996	4	8	16	0	233	96	35	0	0.00%	25	6.43%
1996	4	9	24	2	193	168	36	5	1.00%	95	19.04%
1996	4	12	235	0	1914	1741	2307	14	0.23%	2	0.03%
1996	4	13	102	0	539	609	29	8	0.67%	3	0.25%
1996	4	17	125	0	1333	826	87	1	0.04%	1	0.04%
1996	4	26	81	0	184	24	216	1	0.22%	28	6.18%
1996	4	28	355	1	2145	1400	817	26	0.57%	169	3.71%
1997	4	3	49	0	392	255	488	71	5.76% ***	27	2.19%
1997	4	5	46	2	208	96	177	11	2.20% **	5	1.00%
1997	4	6	161	0	735	140	326	34	2.67% **	39	3.06%
1997	4	7	107	0	508	275	120	20	2.10% ***	31	3.25%
1997	4	8	22	3	69	46	21	8	5.16% ***	8	5.16%
1997	4	9	268	0	2008	1156	363	16	0.44% **	94	2.58%
1997	4	10	132	0	784	451	108	77	5.18% ***	67	4.51%
1997	4	12	512	6	4376	300	6602	135	1.18% ***	23	0.20%
1997	4	13	146	0	588	110	1123	40	2.14% **	5	0.27%
1997	4	14	225	0	968	798	1685	2	0.06%	10	0.29%
1997	4	15	176	0	1537	514	2703	41	0.85%	23	0.48%
1997	4	16	100	0	333	532	481	10	0.73% *	11	0.80%
1997	4	25	101	0	917	203	1723	16	0.55% *	25	0.87%
1997	4	26	116	36	925	141	912	7	0.34% *	14	0.69%

* - parts at or below spawner index when closed in 1996 and berried females < 1%

** - parts at or below the spawner index when closed in 1996

*** - significantly below spawner index when closed in 1996

Table 4.3.10.1. Summary of 1996 In-season Monitoring Results

Area	Month	Sub-Areas Sampled	No. of Traps Sampled	No. of Vessels	Mean Index	Upper 75% C.I.	Target Index	Sample Days	Management Decisions
2	August	3,8,8,9	371	4	4.2	4.8	4.4	4	all closed 15-Aug
3	May	4,6,10	80	3	1.8	2.3	5.9	3	all closed 4-Jun
5	May	2,16,17,24	141	5	8.2	9.2	5.9	5	
	June	2,14,16,17,23	321	5	5.1	7.0	5.4	4	1 to 9, 23, 24 closed 10-Jul
	July	13,14,16,17,19	309	3	5.7	7.1	4.9	3	remainder closed 31-Jul
6	May	1,3,4,5,8,12,17,19	464	9	8.9	9.9	5.9	11	subs 1 to 4 closed 19-Jun
	July	5,6,8,10,12,19,20,21,23,26	985	10	4.8	5.3	4.9	10	subs 12 to 19 closed 24-Jul
7	April	18	14	1	6.3		6.4	1	
	May	7,9,10,11,12,14,15,16,18,24	538	9	5.8	6.3	5.9	10	
	June	9,10,15,18,23	265	2	4.8	5.4	5.4	3	
	July	9,10,11,12,13,15,16,18,19,24	578	7	3.1	3.4	4.9	7	all closed 24-Jul
8	April	6	16	1	8.2		6.4	1	
	June	2,7,8,9,11,12,13	684	8	4.3	4.7	5.4	8	
	July	2	240	1	2.4	3.0	4.9	2	all closed 26-Jun
9	April	2,4	24	1	10.6	15.2	6.4	1	
	June	4	76	1	0.9	0.9	5.4	1	all closed 29-Jun
	July	9	60	1	3.7	4.2	4.9	1	
10	June	4,5,10,12	247	5	3.6	4.3	5.4	3	all closed 26-Jun
12	April	22,23,26,27,35,41,43	250	6	18.8	21.0	6.4	6	
	May	26,35,36,39,40,41,43	715	11	6.8	7.5	5.9	7	subs 28 to 34, 40 to 48 closed 12-Jun
	June	23,26,27,39	526	7	7.6	8.3	5.4	8	
	July	23,26	191	3	3.1	3.7	4.9	3	
	August	36,38,39	172	3	2.4	2.7	4.4	2	remainder closed 15-Aug
13	April	42,43	100	2	9.7	12.8	6.4	3	
	May	14,15,16,17,18,19,20,21,22,42	356	9	12.5	13.4	5.9	6	
	June	21,42,43	216	4	9.7	10.9	5.4	5	
	July	1,14,15,16,17,18,19,21,22	566	11	7.4	8.0	4.9	7	
	August	43	78	1	1.8	2.6	4.4	1	all closed 15-Aug
14	May	3,12	120	3	13.1	15.1	5.9	3	
	June	3,6,12	100	4	8.7	10.1	5.4	4	
	July	2,3,5,7,9,12,13	270	7	6.3	7.0	4.9	5	subs1 to 5 closed 31-Jul
	August	9,12	16	1	9.2	11.7	4.4	1	sub 7 closed 8-Aug; remainder closed 15-Aug
15	May	1,2,3,5	226	5	12.8	13.6	5.9	5	
	June	3,5	226	2	8.7	10.1	5.4	2	
	July	2,3,5	124	2	7.2	8.4	4.9	2	all closed 15-Aug
16	May	1,11,18,19,21	298	4	7.5	8.0	5.9	4	
	June	1,2,10,11,17,18,19,21	419	9	5.1	5.5	5.4	7	subs 10, 17, 19 to 21 closed 19-Jun
	July	11,12,13	222	2	3.5	4.1	4.9	2	subs 1 to 4, 16, 18 closed 5-Jul; subs 9, 11 to 15 closed 11-Jul
	September	6,7,8	431	12	1.2	1.5	4.1	2	subs 5 to 8 closed 20-Sep (special management area)
	November	5,6,7,8	260	1	4.4	5.1	3.2	4	
17	April	11,12	125	2	13.6	15.0	6.4	2	
	May	5,6,11,18	61	2	12.7	14.3	5.9	2	
	June	5,6,9,11	213	4	7.4	8.4	5.4	4	
	July	10,12,13,15	128	3	8.1	9.2	4.9	3	
	August	5,9	115	3	3.7	4.5	4.4	2	all closed 15-Aug
19	September	7,8	290	11	7.2	8.1	4.1	4	subs 7 to 12 closed 23-Sep (special management area)
23	June	5,6	114	1	3.4	3.9	5.4	2	subs 4 to 11 closed 3-Jul
	September	1,2,3	818	18	3.6	4.0	4.1	7	subs 1 to 3 closed closed 23-Sep (special management area)
25	May	2,3,4,5,6,8,9,13,15,16	546	5	8.9	9.8	5.9	8	
	June	5,6,8,9,10,13,15,16	448	4	7.5	8.5	5.4	5	subs 2 to 5 closed 19-Jun; subs 9 to 14 closed 3-Jul
	July	6,8,16	112	2	3.3	3.6	4.9	2	
	August	8	1	1	5.3		4.4	1	subs 6 to 8, 15, 16 closed 8-Aug
26	April	2,4	81	1	3.0	3.8	6.4	1	
	May	2,4,5	160	1	5.7	6.5	5.9	2	all closed 4-Jun
28	March	1,2,3,4,5	854	1	2.0	2.2	1.7	8	
	April	1,2,3,4	355	5	7.2	8.1	6.4	3	subs 1 to 5 closed 25-Apr
	September	2,3,4,5,12,13	* 906	21	2.3	2.5	4.1	6	subs 2 to 5, 11 to 14 closed 16-Sep (special management area)
	October	1,2,3,4	603	1	4.3	4.6	3.6	7	
	November	1,2,3	221	1	4.3	5.0	3.2	2	
29	August	2	126	1	1.1	1.2	4.4	1	all closed 15-Aug
All									All remaining areas closed coastwide 15-Aug

* 35 strings were part of a Science research survey.

Table 4.3.10.2. Summary of 1997 In-season Monitoring Results

Area	Month	Sub-Areas Sampled	No. of Traps Sampled	No. of Vessels	Mean Index	Upper 75% C.I.	Target Index	Sample Days	Management Decisions
3	April	6	49	2	20.0	21.2	6.4	1	
	May	6,7,8,10,17	375	4	3.0	3.6	5.9	4	
	June	10	86	1	1.9	2.4	5.4	1	all closed 12-Jun
4	June	5	207	2	4.7	6.0	5.4	2	all closed 16-Jul
5	April	17,24	46	3	7.2	8.9	6.4	2	
	May	14,15,16,17,19,23	256	5	4.3	4.9	5.9	4	all closed 4-Jun
6	April	1,3,4,6	161	4	3.3	4.1	6.4	4	
	May	1,5,19,20,24,25	391	9	6.2	6.8	5.9	6	sub 19 closed 4-Jun
	June	1,3,5,12,16	438	7	3.6	4.0	5.4	6	remainder closed 24-Jun
7	April	14,16,17	107	4	4.9	5.5	6.4	3	
	May	5,9,12,13,14	369	6	2.8	3.1	5.9	6	all closed 23-May
8	April	14	22	1	3.1		6.4	1	
	May	5,7,12	334	4	3.3	3.7	5.9	4	subs 5 to 12 closed 12-Jun
	June	10,13,16	317	4	2.2	2.6	5.4	4	remainder closed 2-Jul
9	April	1,3,6,7,8,12	268	6	6.0	7.2	6.4	5	
	May	2,3	101	1	6.4	6.8	5.9	2	subs 2 to 11 closed 15-May
	June	12	76	1	2.5	3.6	5.4	2	remainder closed 2-Jul
10	April	5,12	132	2	3.6	4.6	6.4	2	
	May	4,6,7,10,12	222	4	7.7	8.6	5.9	3	
	June	5,7,12	251	3	3.8	4.6	5.4	2	all closed 2-Jul
11	July	2,3,5,8,10	490	7	3.5	4.2	4.9	6	all closed 29-Jul
12	April	7,23,26,27,35,40,41,43	512	9	15.2	16.5	6.4	6	
	May	23,26,27,35,36,39,40	581	9	11.4	12.4	5.9	7	
	June	27,29,30,40,41	588	9	6.5	7.0	5.4	6	subs 20 to 48 closed 10-Jul
	July	2,7,13,16,35	156	4	7.9	9.0	4.9	4	remainder closed 29-Jul
13	April	42,43	146	2	11.5	13.3	6.4	2	
	May	12,15,16,18,20,21,22	313	5	15.9	17.4	5.9	5	
	June	15,16,17,18,20,42,43	334	6	8.8	9.5	5.4	5	
	July	12,13,14,15,19,22,36	516	7	7.9	8.5	4.9	8	subs 21, 22, 42, 43 closed 17-Jul; remainder closed 29-Jul
14	April	3,5,8,9,12	225	4	17.6	19.1	6.4	3	
	May	8	12	1	12.3		5.9	1	
	June	8,12,13	154	2	14.4	16.1	5.4	2	
	July	2,3,5,8,12,13	495	7	6.8	7.3	4.9	5	all closed 29-Jul
15	April	2,3,5	170	3	33.7	35.9	6.4	2	
	May	1,2,3,5	318	4	12.2	13.2	5.9	4	
	June	2,3,5,8	468	5	9.6	10.5	5.4	5	sub 8 closed 10-Jul
	July	1,2,3,5	465	8	9.5	10.1	4.9	6	remainder closed 29-Jul
16	April	11,19,21	100	3	10.8	12.0	6.4	3	
	May	6,7,8,11,12,21	384	8	9.0	10.2	5.9	7	
	June	2,6,10,11,13,16,17,18	286	5	8.6	9.4	5.4	4	
	July	1,2,10,16,17,18,19,21	331	7	10.1	10.9	4.9	6	all closed 29-Jul (subs 1 to 5 are a special management area)
17	May	5,8,10,12,13,18	194	5	13.0	14.1	5.9	3	
	June	5,6,9,12	272	5	8.9	9.4	5.4	4	
	July	5,6,9,10,12,13,14	489	14	8.2	8.9	4.9	8	all closed 29-Jul
19	May	7,8	143	2	16.2	17.7	5.9	5	
	June	7,8,10	79	1	9.0	11.2	5.4	2	subs 7 to 12 (special management area) closed 24-Jun
23	May	1,2,3,4,6	362	7	11.6	12.7	5.9	9	
	June	1,2,4,6,10	433	4	11.1	12.2	5.4	8	
	July	1,2,3,6,8	201	6	3.6	4.1	4.9	4	all closed 17-Jul (subs 1 to 3 are a special management area)
25	April	4,5,9	101	2	18.9	20.7	6.4	2	
	May	1,3,8,9,10,13,15	306	4	11.3	12.1	5.9	5	
	June	1,2,4,5,6,8,9,11,13	757	5	6.4	6.7	5.4	8	all closed 10-Jul
26	April	4,5,9	116	2	9.5	10.4	6.4	3	
	May	2,4,5	97	1	9.4	10.3	5.9	1	all closed 17-Jul
27	May	7,8,9	125	1	6.1	7.0	5.9	2	all closed 17-Jul
28	March	1,2,3,4,5	758	1	1.6	1.8	1.7	8	
	May	1,2,3,4,5	744	4	10.1	10.7	5.9	11	
	June	1,2,3,4,12	761	6	8.0	8.5	5.4	10	subs 1 to 4, 11 to 14 closed 2-Jul (special management areas)
29	May	3	24	1	1.2		5.9	1	
	July	1,2	492	3	6.1	6.9	4.9	3	subs 1 to 4, 6, 7, 9, 10 closed 23-Jul
All									All remaining areas closed coastwide 29-Jul

Table 4.3.11. Eighteen Year Summary of the Total Number of Traps Sampled for In-season Assessment of the Prawn Fishery.

AREA	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980
2		371																
3	510	80	71							124		69	31	23	30			
4	207		42									38	16					
5	302	771	50															
6	991	1429	535										44		64			
7	476	1395 [1]	532		175	150	129	167						62			171	116
8	673	950 [2]	64			75			226									267
9	445	160 [3]	374			90												
10	605	247	180															
11	490		143															
12	1837	1854	2321 [4]	435	482	749	867	1033	486	677	821	1625	898	366	553	264	453	665
13	1309	1351	586	374			276	124	366	333		173	343	267			30	285
14	886	506	493	736	427		360	695	419	42	56	35	302	42		100		
15	1427	578	1390	753	370	220	523	177	958	822		123	1022					
16	1111	1630	1568	1321	621	721	1484	783	1246	1837	673	473	601	1457	414	526	1884	728
17	955	662	1076	292	194	291	873	342	66	81	114	290	741	326	45	602	497	335
18															-	148	955	521
19	222	290	653	186	241	315	273	1240	173	116	440	343		284	288			
23	1016	932	997	359	169	442	14				103	259	763	811	555	1408	683	708
25	1164	1107	1186						297	300	116	189	757	659	762	1557	921	1522
26	213	241	229					221										
27	125		323	136				52					139			288	-	
28	1505	1261	546												365	558	648	
29	516	126	76											180				
Total	16985	15941	13435	4592	2679	3053	4799	4834	4237	4332	2323	3617	5657	4477	3076	5451	6242	5147

[1] 480 traps in Area 7 were sampled as part of a Science research survey

[2] 240 traps in Area 8 were sampled as part of a Science research survey

[3] 60 traps in Area 9 were sampled as part of a Science research survey

[4] 760 traps in Area 12 were sampled as part of a Science research survey

Table 4.3.12. Summary of humpback and coonstripe shrimp landings (tonnes) by trap as reported on harvest logs.

	TOTALS										
	Total Coast (t)	North Coast (t) *	South Coast (t)	ECVI (t)	WCVI (t)						
						1	2	3	4	5	6
1987	23	7	16	6	11	1.06	0.38	1.41	3.16	0.08	0.29
1988	21	10	11	3	9	0.65	0.33	0.64	5.06	0.10	1.18
1989	39	22	17	5	13	2.92		0.42	12.14	0.10	2.24
1990	23	13	10	5	5	1.90	0.01	0.96	6.69	0.34	2.18
1991	23	12	11	1	10	3.14		0.54	5.49	0.49	1.23
1992	21	15	6	3	3	2.48	0.11	0.47	9.20	0.21	0.76
1993	21	17	4	1	3	2.45		0.21	9.56	0.17	1.90
1994	28	18	10	3	7	1.27		0.37	9.73	0.93	1.43
1995	84	77	7	2	5	0.83		2.44	50.93	7.73	8.99
1996	63	58	5	2	3	1.98	0.01	2.45	23.35	14.63	9.05

	East Coast Vancouver Island											West Coast Vancouver Island							
	11	12	13	14	15	16	17	18	19	28	29	20	21	22	23	24	25	26	27
1987	0.12	1.34	0.00	0.01			0.05			0.01		10.28			0.00				0.17
1988	0.05	0.99	0.02			0.13	0.00			0.30		8.37			0.16				
1989	0.12	0.34	0.61	0.04	1.46		0.37	0.01				12.01			0.00		0.02		0.00
1990	0.09	0.38	0.00	0.21		2.03						4.97			0.10				
1991	0.03	0.24	0.08	0.14	0.02	0.18	0.00					9.69						0.00	
1992	0.22	0.04	0.27			0.45	0.00			1.01		3.12							
1993	0.05	0.36	0.24	0.00	0.01	0.05						2.34							0.30
1994	0.04	0.53	0.06		0.05	0.57				0.76		6.67							0.02
1995	0.09	1.05	0.09			0.01		0.00		0.04		4.66							
1996		0.33	0.41	0.00			0.01			0.01		3.33			0.01				

Areas 1 and 4 are humpback shrimp.
Area 20 is coonstripe shrimp.
All other areas cannot be broken out into species due to possible misreporting by the fishers on their logbooks.

4.4. Euphausiid Fishery - B. Koke and K. Kattilakoski

4.4.1 Introduction

About twenty species of euphausiids occur in B.C. waters, but five dominate the biomass: Euphausia pacifica, Thysanoessa spinifera, T. inspinata, T. longipes and T. rashii. Only one or two species contribute significantly to the biomass at any one location. E. pacifica is typically one of the dominants and accounts for 70 - 100% of the euphausiid biomass in the Strait of Georgia where the commercial fishery occurs (Jamieson et al, 1990). Some commercial concentrations of euphausiids have been identified on the West Coast of Vancouver Island and near the southern end of the Queen Charlotte Islands (Fulton and LeBrasseur, 1984).

A trawl fishery, largely for E. pacifica, began in the Strait of Georgia in 1970 as an experimental fishery and was licensed under category "Z-F" in 1983. This licence became limited in 1993 for which 18 fishermen qualified. The maximum number of vessels reporting landings in any given year was 17 in 1990. This declined to less than three vessels in 1993, increased again to 6 in 1994, 7 vessels in 1995, 10 vessels active in 1996, and 12 vessels active in 1997 (Table 4.4.1).

Most of the euphausiids commercially harvested are frozen for use in the manufacture of fish food. A small portion of the catch is freeze dried and used as aquarium pet food. The whole landed value of euphausiids varied between \$.23 and \$.88 kg^{-1} between 1984 and 1996. The price varied between \$.73 and \$1.26 kg^{-1} in 1997 with an average of \$0.88 kg^{-1}. The total landed value of the euphausiid fishery is comparatively small varying between \$38,000 in 1984 and \$472,000 in 1996. (Table 4.4.1.) Landed value in 1997 was approximately \$209,000.

4.4.2 Fishery Management Objectives

The Euphausiid fishery is managed by applying a precautionary 500 t quota to the fishery in the southern coastal statistical management Areas 12, 13, 15, 16, and 28. January 1 to May 31 openings occur in mainland inlet areas with specific quotas assigned for each area. The inlet areas may be reopened August 16 to October 31 upon request of the fishers, to harvest any remaining quota in these areas. Malaspina Strait area opens November 01 to December 31 for harvesting a 215 t quota, plus any quota remaining from the inlet areas. In 1998 the Resource Management Executive Committee (RMEC) once again affirmed that as a matter of policy the region is not prepared to support a quota increase above 500 t or to allow for expansion in fishing areas.

4.4.3 Fishery Management Actions

Quotas were established in 1976 for the euphausiid fishery due to concerns of harvesting a forage species upon which salmon and other commercially important finfish depend. The annual catch was set at 500 t with an open season from November to March to minimise the incidental catch of larval and juvenile fish. The quota was estimated to be less than 3% of the annual consumption of euphausiids by all predator species in the Strait of Georgia. The opportunity to fish in Howe Sound for a 25 t quota was introduced in 1986. In 1989 the annual quota was increased to 785 t, 500 t for the Strait of Georgia and 20 to 75 t each for several major mainland inlets. In 1990 due to concerns for declining catch rates and potential local overfishing in Jervis Inlet and Howe Sound, the inlet quotas were subtracted from the Strait of Georgia quota resulting in a quota of 215 t for the Strait and a total annual quota of 500 t. Also commencing in 1990, the inlets remained open in the spring fishery until May 31.

In 1991, acting on the advice of industry, the Department of Fisheries and Oceans provided for a split season in the inlet areas for the periods of January to May and August 16 through December 31.

The Strait of Georgia fishery was limited to the period of November through December only. This was modified again in 1992, also on the advice of industry, so that the mainland inlets were open August 16 as in 1991 but to November 4 only. The Strait of Georgia opened November 4 with a quota of 215 t, as in 1991, plus the balance of the remaining quotas from the mainland inlets. This was to ensure that industry would be able to harvest the entire 500 t quota. Previous to this, portions of quotas were left in some of the mainland inlets, as it was uneconomic to complete the quotas.

The 1993 quotas were the same as for the 1992 season with the exception of Loughborough Inlet where the quota was eliminated and transferred to the Homfray-Price-Lewis (HPL) quota. This was done in consultation with industry as fishers indicated that there were not sufficient stocks in Loughborough Inlet to support a fishery. In 1995 at the request of industry, the Inlet areas would close for the season no later than September 30 and the Malaspina Strait Area opening was moved ahead to October 01. In addition, the Malaspina Strait area was expanded to include a portion of subarea 16-11 (lower Jervis Inlet) to provide for safer fishing operations during adverse weather conditions. This pattern was followed again in 1996. In 1997 the fishers requested alteration of the fishing plan to provide for an Inlet area opportunity until the end of October, with the Malaspina Strait fishery delayed until November 01.

The winter-spring opening period for the Inlet areas was reduced by two months to January 01 to March 31 for 1997. No fishing activity or landings had been reported after March 31 in the previous three years (1994 to 1996). Eliminating the fishery during the months of April and May was done to avoid potential by-catch of juvenile salmonids and other juvenile fish. The reduction in the time period of the fishery also had the potential to reduce the resources required to monitor the fishery.

Prior to 1997 the various quotas were managed through weekly hails from fishers to fishery managers to advise of their fishing area and catches, as a condition of licence. Compliance with this method of management varied, (in some cases due to poor communication links with remote areas) resulting in inadequate hailing practices, quota overages, and inconsistent hail and sales slip data. Before 1990 the total annual 500 t quota had never been reached. However in both 1995 and 1996 (Table 1) the quota was exceeded according to sales slip data, whereas hail data reflected landings below the annual 500 t quota. The inconsistency in data was considered to be unacceptable particularly in light of public sensitivity to the fishery and limited resources available within DFO to monitor the fishery. As a result of the data discrepancies, changes to the management plan were implemented in 1997 through the introduction of an industry funded third party "hail in and dockside validation" program.

Openings and Closures

Year	Inlets, winter/spring	Inlets, summer	Strait of Georgia
1990	inlets close Mar. 31		
1991	inlets close May 31		
1992	"	Open Aug.16 - Nov.1	Open Nov.4 - Dec.31
1993	"	Open Aug.16 - Nov.1	Open Nov.1-Dec.31
1994	"	Open Aug.16 - Oct.1	Open Nov.1-Dec.31
1995	Bute Inlet closed Feb 10. Remaining Inlet areas closed May 31	no request to open	Open Oct.1 - Dec.31

1996	Toba Inlet closed Jan 19; Butte Inlet closed Feb 22; and Jervis Inlet and Homfrey - Price - Lewis channels closed Mar 19.	no request to open	Open Oct 01 - 16.
1997	Jervis Inlet closed Jan 8 (1 night); Homfrey-Price-Lews Channels closed Feb 19; Bute and Toba Inlets closed Feb 20.	no request to open	Open Nov 01 to Dec 31.

4.4.4 Catch and Effort

Table 4.1.1 describes catch and effort for the period 1983 through 1997 as reported on harvest logs, sales slips, and commencing in 1997 validated landings. The 1997 fishery was managed in season by validated landings. Inconsistencies are evident in sales slip, logbook, and validated data for the 1997 season. To reduce these data discrepancies the logbook and validated information should be combined into a single format for future years. This change will be introduced in 1998. Sales slip information may be difficult to correlate more accurately due to the way the product is marketed. Often product is sold well after the time it was caught and processed.

The number of licences issued for this fishery increased annually from 7 in 1983 to 56 in 1990 then declined to 45 in 1991(Table 4.1.1). In 1993 licences were limited to 18 vessels upon the advice of industry and because the annual quota was being taken by the current fleet. Effort continued to fluctuate in the fishery after limited entry. Only one vessel reported euphausiid landings during 1993. Data indicates that 12 vessels landed euphausiids in 1997.

4.4.4.1 Landings

Annual landings of euphausiids according to sales slip data increased from 47 t in 1983 to 530 t in 1990. Total catch then declined to 53 t in 1993 and then increased to a record high of 562 t in 1995. Sales slip data for 1997 indicate 239 t, however validated landing records reflect that a total of 382 t of product were actually harvested, weighed, and confirmed landed in the fishery. The decrease in landings in 1997 from the 507 t taken in 1996 may be indicative of a less aggressive fishing and marketing effort as well as an overall decrease in abundance of stock in the Malaspina Strait area during the fall opening. Stock strength in Jervis Inlet appeared to be healthy in January where 7 vessels landed most of the target quota of 85 t in one night of fishing. However the Fall opening in the Malaspina Strait area revealed lower abundance of stocks and minor bycatch (less than 0.5 %) of non-target species (i.e. 2-3 year old herring) in some landings. Some fishers believe that the fall period sea surface temperature of 2-3 degrees C above normal may account for different and deeper stock distribution. It was also noted that in the winter fishery stock did not tend to concentrate in the surface layers or in the same areas as in the January fishery, or in the patterns of recent years.

The 1997 "hail in and dockside" validation program was effective in preventing quota overages. The observer staff was requested to inspect and sample catches in season. This provided for confirmation and an appropriate assessment of the by-catch observed in the 1997 fishery. This management program is being continued in 1998 with changes in data reporting to combine the validation and logbook information into a single report.

4.4.4.2 Effort

Two types of vessels participate in this fishery; smaller freezer vessels whose catches are limited due to freezing capacity and larger vessels which land large quantities of euphausiids for onshore processing and freezing. Catch must be frozen within 24 hours to avoid a significant deterioration of product and corresponding reduction in quality and value.

From 1983 to 1987 effort (hours trawling) reported on harvest logs was relatively constant and varied between 333 and 563 hours annually (Table 4.1.1). Between 1988 and 1996 effort varied considerably, from 188 hours to 1321 hours in that time. In the 1997 fishery the effort totalled 894 hours.

The euphausiid fishery has been market limited but interest is increasing. Fishers advise that market limitations result from the limited nature of the quotas which prevent development of better markets that would be based upon guaranteed minimum delivery of product. They suggest the current quotas prevent fishers from committing to these types of arrangements, as significant production cannot be assured.

Alternate value added products are being examined by industry to enhance the potential of the fishery. This is supported both by DFO and the Krill Trawlers Association through assigning the option for 10 t of the total annual quota to be available for the development of new fishing techniques and to promote improved quality to landed products. Interest remains high in pursuing new approaches to improving product value particularly in light of the current limitations in quota. Regulatory adjustments with respect to limitations with processing at sea are expected from industry to provide for improved product value.

4.4.4.3 CPUE

Catch per unit effort ($kg \cdot hr^{-1}$) reported on harvest logs has varied from 65 to 764 $kg \cdot hr^{-1}$ from 1983 to 1997 (Table 4.1.1). During the year of highest effort (1990) CPUE was 378 $kg \cdot hr^{-1}$. The highest catch rates (764 $kg \cdot hr^{-1}$) were reported in the 1996 fishery. The CPUE in 1997 was 361 $kg \cdot hr^{-1}$, a significant decrease from recent years however the most significant reduction was apparent in the Malaspina Strait opening in November. Comments on CPUE are speculative only. A decrease in CPUE may result from a combination of factors - i.e. decreased stock abundance, above average sea surface temperatures, different stock distribution, and/or an absence of a market for the product.

4.4.5 Enforcement Concerns:

This fishery is a low priority fishery for the Conservation and Protection Sector. There are very few if any patrols conducted, the fishery occurs at night with most landings reported between November and January. Weather conditions are generally poor at this time of year and availability of patrol vessels is reduced.

The new industry funded "hail in and dockside" validation program initiated in 1997 was effective in addressing quota overages and reporting concerns in the fishery. The new program provided for timely and accurate tracking of catches and fishing activities. Discrepancies in the sales slip, harvest log, and validated landing data continue. Harvest log and validated landing data will be combined into a single report beginning in 1998. Sales slip information deficiencies may be more challenging to rectify due to the marketing process where product may be sold long after in has been harvested. Future enforcement efforts may be best directed at "forensic audits" to confirm the accuracy of the dockside validation program and to clarify discrepancies in sales slip and validation data.

4.4.6 Stock Assessment Activities

4.4.6.1 Research

Staff from DFO staff from the Institute of Ocean Sciences carried out biomass estimates of euphausiid in Jervis Inlet and Malaspina Striate twice annually in most years. Survey results for the Jervis Inlet survey conducted in February 97 were unavailable, however it should be noted that abundance appeared to be well below average in Oct 97 in Jervis Inlet. Samples from the commercial fishery and research net tows were not compared in 1997. (Mackas, D 1999 Personal communication).

In 1994, 1995, and 1996 acoustical mapping surveys with verification tows, were conducted by DFO Science Branch in Jervis Inlet and Malaspina Straits areas in October/November prior to fishing effort and again in January/February after fishing efforts had ceased. Also between June 1994 and the Summer of 1995 joint DFO/industry monthly surveys were conducted supported by external funding sources. The results of these surveys indicate that the present harvest levels are a small fraction of annual average standing stock. (Mackas. D 1996 personal communication). In addition, industry is currently conducting research on development of value added products.

4.4.7 Priority Issues

- The Resource Management Executive Committee (RMEC) has restated that as a matter of policy the region is not prepared to support a quota increase beyond 500 t or expansion of the fishery into new areas on this forage species. With the implementation of effective industry funded monitoring programs, fishers are interested to determine the circumstances that would lead to new developments in the fishery. The PSARC shellfish subcommittee recommended review of the recent survey data in 1997 to determine if the information available is adequate to promote a meaningful review of the current policy.
- Individual inlet quotas were first established to provide industry with opportunities in mainland inlets. This was successful as reflected in landings reported for 1989 to 1991. The more recent practice of transferring unused quotas to Malaspina Strait continues to re-centralise the fishery. Stock assessment surveys should be continued in areas of intensive harvest such as Jervis Inlet and Malaspina Strait, particularly if this pattern persists and/or increases.
- Alternate value added products are being examined by industry to enhance the potential of this fishery. Since 1994 both DFO and the Krill Trawlers Association supported this through changes to the fishing plan. Joint DFO and industry research has been undertaken and should be continued to promote increased value of product landed.
- New Industry funded management initiatives initiated in 1997 to improve the accuracy and consistency of hail, logbook, and sales slip data should be improved on and continued in 1998. The third party monitoring program prevented quota overages provided accurate in season quota tracking and resulted in improved landing data quality in 1997. Logbook and validation reports will be combined into a single report in the 1998 fishery.
- A significant number of license holders are interested in the DFO process to establish individual vessel quotas. Also there is an interest in changes to the restrictions in

processing of catch. Changes have been requested by some licence holders to allow the freezing of catch at sea by vessels other than the licensed catcher vessel.

4.4.8 References

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Mackas, D. 1999 Personal communication.

Table 4.4.1. Euphausiid landings (tonnes) and effort for British Columbia, 1983 to 1997, as reported on fish slips, harvest logs and validated landings.

Year	Type and Number of Licences Issued	Number of Vessels with Landings[1]	Fishing Days[1]	Quota (t)	Landings[1] (t)	Landings[2] (t)	Landings[3] (t)	Landed Value[1] ($10-3)	Whole Landed Value[1] ($*t-1)	Effort[2] (hours)	CPUE[2] (kg hr-1)
1983	7 Z-F	<3	50	500	*	*		*	*	*	*
1984	8 Z-F	4	67	500	94	103		38	404	563	182
1985	5 Z-F	<3	65	500	*	*		*	*	*	*
1986	11 Z-F	<3	67	525	*	*		*	*	*	*
1987	18 Z-F	3	36	525	130	156		102	785	370	421
1988	24 Z-F	4	11	525	247	249		191	773	980	254
1989	45 Z-F	15	225	785	360	298		215	597	1150	259
1990	56 Z-F	17	255	500	530	499		415	783	1321	378
1991	45 Z-F	14	152	500	450	445		391	869	1211	367
1992	25 Z-F	10	89	500	381	343		318	835	470	729
1993	18 Z-F	<3	29	500	*	*		*	*	*	*
1994	18 Z-F	6	122	500	333	375		259	778	614	610
1995	18 Z-F	7	163	500	562	506		357	635	944	536
1996[4]	18 Z-F	10	144	500	507	490		472	931	642	764
1997[4]	18 Z-F	7 (12)[5]	147	500	239	322	382	209	874	894	361

[1] Fish slip data.

[2] Harvest log data.

[3] Validated landings data. Data were validated beginning in 1997.

[4] 1996 and 1997 data are considered preliminary for fish slips.

[5] Fish slips show 7 vessels with landings. Validated landings show 12.

* Data not provided for reasons of confidentiality where less than 3 boats report landings.

4.5. Goose Barnacles (1996/97) - J. Rogers and G. Parker

4.5.1 Introduction

Goose barnacles, Pollicipes sp., are harvested by hand picking in intertidal areas in exposed coastal locations. Chisel-like tools are used to scrape the barnacles from their place of attachment, usually on mussels or other barnacles that are attached to the rocks. A category "Z-6" licence for fishing without a vessel is required to harvest this species.

Goose barnacles are found from Baja California to southern Alaska in the upper inter-tidal zone. Spawning occurs from late spring to early fall, with peak periods usually in July. Larvae are usually planktonic for 30-40 days before settling. The maximum age of goose barnacles is unknown.

Almost all of the harvested barnacles are exported live to Spain. This market is limited and has restricted the development of the fishery. Fishers are experimenting with a Japanese market. Historically the value of this fishery has been relatively minor, ranging between $100,000 and $500,000 annually. The landed value of the product is high, averaging $9.08/kg during 1996 and $9.50/kg in 1997. The reported whole landed value of goose barnacles in 1996 was $112,000 and $96,000 in 1997.

4.5.2 Fishery Management Actions

It is estimated that less than 10% of the total stock is available to the fishery due to inaccessible harvest areas, and/or unsuitable size and quality of product. Therefore, there are currently no limits applied in this fishery. The low portion of the standing stock available for harvest may provide adequate biological protection for the species. Management of this fishery to date has been restricted to area closures, data collection through mandatory harvest logs and limiting harvest to hand tools only.

4.5.3 Catch And Effort

A summary of catch and effort for the period of 1985 through 1997 is presented in Table 4.5.1. Between 1985 and 1988, the number of licences issued to harvest goose barnacles increased from 9 to 467, but has since declined with only about 56 Z-6 licences issued in 1996 and 49 in 1997. Prior to 1990, there was no accurate information on the number of fishers participating in this fishery, as landings were largely reported by buyers and not the harvesters. Through the use of harvest logbooks, recent catch and effort data are more complete. Harvest log information indicates that only 14 licences reported landings in 1996, and 3 licences have landings to date in 1997. The high value of the product and the nature of this fishery, however, has resulted in considerable under-reporting of catch, hence both fish slip and harvest log information for this fishery are incomplete.

4.5.3.1 Landings

Annual landings since 1989 have ranged between 7 and 49 tonnes, but have been on a general decline. Fish slip summaries for 1996 show landings of 14 t. Preliminary fish slip data for 1997 indicate landings of 10 t, however preliminary harvest log data show landings of only 5 t. The majority of the annual catch has been taken from Areas 23, 24, 123, and 124 on the West Coast of Vancouver Island (Table 4.5.2). In the past only minor and periodic landings of barnacles have been reported from the North Coast and other South Coast management areas. An exception was noted in 1994 when 8.8 t (31% of the annual coastwide catch) was landed in Area 1 (Table 4.5.2). In 1997, landings of

goose barnacles in the south coast were reported in every month, indicating a small, but fairly consistent market demand (Table 4.5.3).

The major market for goose barnacles is the live market in Spain and an export certificate is required by the Spanish seafood industry. Export certificates were obtained from the Canadian Food Inspection Agency (CFIA) and quantities exported (net weight – cleaned product) were higher since 1995 than landings reported on fish slips (Figure 4.5.1). This confirms that fish slip reporting in the last few years has underestimated the quantities harvested.

4.5.3.2 Effort

Effort is measured in fishing days, as reported on harvest logs and fish slips. Information prior to 1990 is suspect as comparison of harvest logs and fish slips by licence holder was not possible. Table 4.5.1 shows that effort (number of fishing days on fish slips) has declined since 1991. In 1991, 3070 fishing days were reported, 1482 days in 1994, and 566 days in 1996. Total fishing days for 1997 is 427 (Table 4.5.1).

4.5.3.3 CPUE

The true CPUE (kg-day-1) for this fishery is questionable due to the degree of unreported effort. CPUE varied between 13 kg and 42 kg-day^{-1} from 1986 to 1997. Reported CPUE for 1997 was 24 kg/day.

4.5.4 Stock Assessment Activities

4.5.4.1 Data Collection

The Shellfish Data Unit collected and processed harvest log information for goose barnacles in 1996 and 1997. No new assessment activities or research were undertaken for gooseneck barnacles in either year.

4.5.4.2 Research

Six experimental harvest sites were established in 1985 to assess the impacts of harvesting on goose barnacle populations (Austin, 1985). These sites were reassessed in 1991, to determine rates of recolonization and growth of goose barnacles (Austin, 1992). In 1991, six years after the initial harvest, it was not possible to discriminate between the harvested and unharvested areas within the sites. The size and weight of barnacles harvested in 1991 were comparable but, on average, less than those harvested from these sites in 1985. Differences in weights were largely attributed to the degree of increased culling of the harvested product in 1991 as compared to 1985.

At two of the sites, assessments were also conducted one, two, three and four years following the initial harvest. Differences in recovery rates were noted at each site. At one site there was a significant but varying "set" of goose barnacles after one year, and after three to four years there was no evidence of harvest. At the second site, recruitment was lower and more variable and only after three years was there any significant recruitment to the harvested areas. After four years there were goose barnacles occupying the harvested areas, some of which were of commercial size.

Austin (1992) concluded that populations of goose barnacles could develop within three years when there is successful recruitment the first year after harvest. Recruitment, however, is variable and is likely not an annual event. Bernard (1988) saw no

resettlement during a seven year study (1979 to 1986) and suggested that recolonization of harvested areas is a slow process of ecological succession that could take ten or more years.

4.5.5 Enforcement Concerns

This fishery is a low priority fishery for the Conservation and Protection Sector. Harvester licencing is of major concern. There is reason to believe that poor catch information is the result of illegal harvesting.

4.5.6 Priority Issues

Catch reporting on fish slips and logbooks require enforcement.

A number of experienced fishermen have formed a goose barnacle Co-operative to work on the marketing and management of the fishery. The Department has encouraged this group to form a goose barnacle sectoral committee to deal with coastwide concerns within this fishery. Such a group could provide important information on stock strength, conservation concerns, management changes, and economic development. The implementation of licence limitation in this fishery is a priority issue for the core group of experienced pickers involved in the Co-op.

Experienced pickers are concerned with the localized stock damage caused by inexperienced pickers who are attracted to the high value of this fishery. Of additional concern was a poor market in 1997 that resulted in large quantities of goose barnacles being discarded.

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Table 4.5.1. Gooseneck Barnacle landings (tonnes) and effort for British Columbia, 1985 to 1997, as reported on fish slips and harvest logs.

Year	Type & Number of Licences Issued	Number of Licences with Landings	Fishing Days[1]	Landings[2] (t)	Landed Value[1] (10^{-3})	Whole Landed Value[1] ($*kg^{-1}$)
1985	9 Z	--	145	1	1	1.00
1986	25 Z	--	77	2	4	2.00
1987	221 Z	--	798	32	211	6.56
1988	467 Z	--	1596	49	479	9.78
1989	130 Z-6	--	713	30	343	11.43
1990	137 Z-6	49	2278	37	413	11.14
1991	131 Z-6	30	3070	41	418	10.31
1992	125 Z-6	39	1878	38	448	11.80
1993	105 Z-6	32	2049	30	320	10.67
1994	114 Z-6	37	1482	28	273	9.79
1995	65 Z-6	7	288	7	73	10.30
1996	56 Z-6	20	568	14.3	112	9.08
1997	49 Z-6	19	427	10.1	96	9.50

[1] from fish slip data only

[2] from harvest log and fish slip data

Table 4.5.2. Annual gooseneck barnacle landings (tonnes) by Management Area 1985 to 1997, as reported on fish slips.

	MANAGEMENT AREAS															
	North Coast						South Coast									Annual
Year	1	2	5	7	8	10	11	12	20	21	23	24	25	26	27	Landings
1985																0.0
1986								1.2			0.2	0.2				1.6
1987			0.04					0.2	0.1	0.1	11.0	18.0	0.5	1.3	0.1	31.3
1988		0.2		0.1	0.1	0.7	0.4	0.5	0.2		6.6	19.0	3.0	17.0	0.9	48.7
1989		0.5		0.7	1.2		0.1	0.1			3.9	11.0	0.1	12.8		30.3
1990					0.4						8.0	13.0		15.0	1.0	37.4
1991								0.33			9.0	16.0	0.4	15.0		40.7
1992					0.2			0.4			2.6	5.7		28.5	0.2	37.6
1993		0.06					0.06				5.1	9.3		15.5	0.1	30.1
1994	8.8			0.2							7.5	4.8	1.4	5.1	0.1	27.9
1995											1.0	0.8		5.3		7.1
1996											4.7	6.9	0.3	2.4		14.3
1997[1]								0.5			4.2	5.1	*	0.2		10.1
Totals:	8.8	0.8	*	1.0	1.9	0.7	0.6	3.2	0.2	0.1	63.8	109.8	5.7	118.0	2.4	

* less than 100 kg

[1] 1997 preliminary data only

Table 4.5.3. Summary of goose barnacle landings (tonnes) by month in South Coast Management Areas in 1997, as reported on fish slips and harvest logs.

Month	Fish Slips								Monthly Totals	Harvest Logs							Monthly Totals
	12	20	21	23	24	25	26	27		20	21	23	24	25	26	27	
January				0.24	0.05				0.28			0.02					0.02
February	0.07			0.19	0.31		0.16		0.74			0.01	0.03				0.04
March	0.13			0.15	0.23				0.50			0.10	0.06				0.17
April				0.45	0.97				1.42			0.25	0.44				0.70
May				1.28	0.66	0.03			1.97			0.30	0.57				0.87
June				0.40	0.49				0.89			0.00	0.51		0.03		0.54
July	0.32			0.46	0.87				1.64			0.07	0.73				0.80
August				0.28	0.70				0.98			0.00	0.67				0.67
September				0.32	0.39				0.70			0.15	0.20				0.35
October				0.14	0.39				0.53			0.09	0.10				0.20
November				0.32	0.00				0.32			0.12					0.12
December				0.01	0.05				0.06			0.12					0.12
Area Totals	0.51			4.23	5.13	0.03	0.16		10.05			1.24	3.32	0.00	0.03		4.59

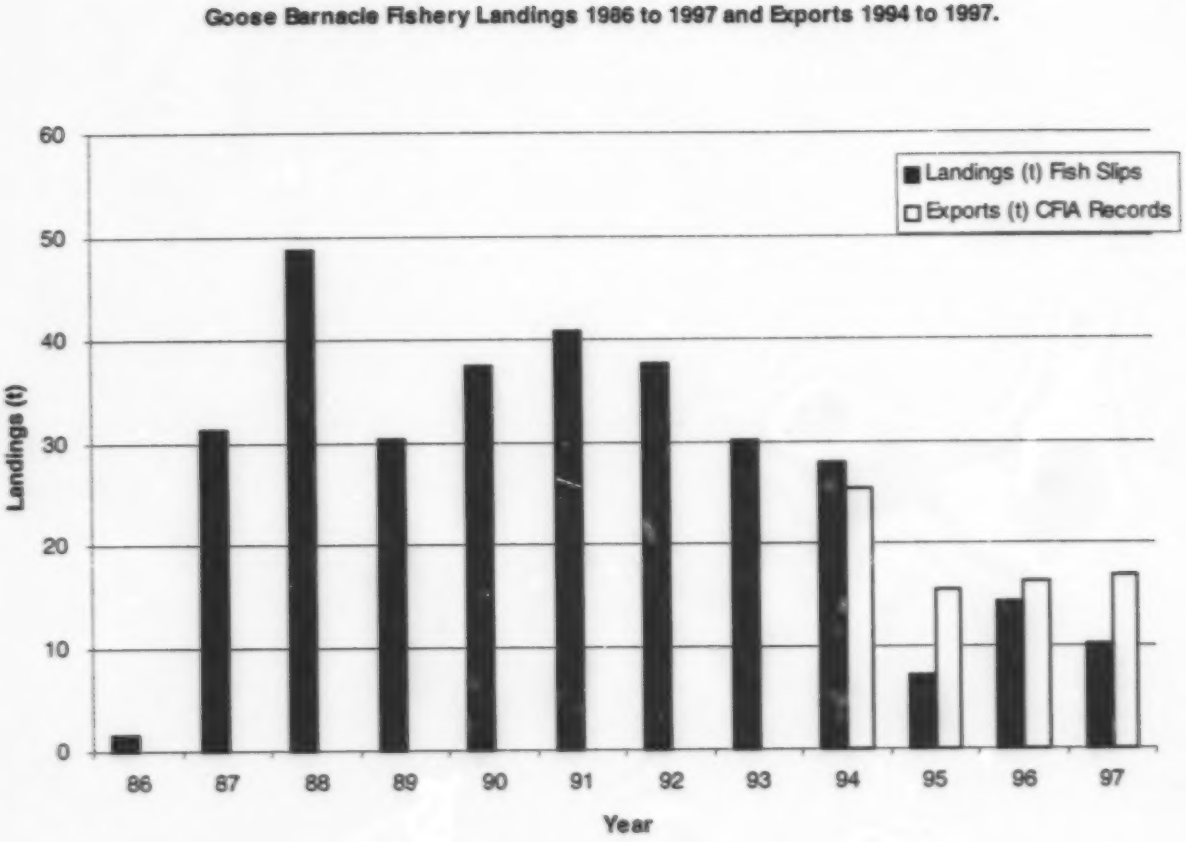

Figure 4.5.1. Goose Barnacle Fishery Landings 1986 to 1997 and Exports 1994 to 1997.

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